KNOWLEDGE INTEGRATION IN WATERSHED PLANNING

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ABSTRACT

Watershed planning and management relies on a diverse range of stakeholders. Collaborative planning can provide an opportunity for those stakeholders to equitably share their knowledge and learn from other participants, but such an outcome cannot be assumed. This research explores the potential for improved knowledge integration in watershed planning through research of a community-based watershed planning initiative in rural Saskatchewan, Canada. Using semi-structured interviews and document review, this research identifies different knowledge types involved in watershed planning, explains how that knowledge is integrated through the planning process, and derives lessons for future watershed planning initiatives. Four general knowledge types identified in the analysis—bureaucratic, administrative, local, and scientific—were also evident in the literature. Specifically, this research affirms local knowledge characteristics—that it is spatially constrained, heterogeneous, generated through a relationship with place, and accrued over time—described in the literature. Results also reinforce claims that clearly defining boundaries between knowledge types is difficult and even undesirable. Differing from the descriptions in the literature of bureaucratic knowledge as including aspects of administrative knowledge, this research proposes that a greater delineation between the two is advantageous to ensure adequate knowledge is present to support the planning process. Two broad themes of how different types of knowledge influenced the planning initiative are presented: cooperation for long-term planning—highly influenced by administrative and bureaucratic knowledge; and setting and achieving goals—dominated by scientific knowledge as an ecological narrative throughout the process. These themes echo the collaborative planning literature on the importance of including as many knowledge types as possible throughout the process, while also revealing the necessity of ensuring that all participants are engaged in deliberations in order to contribute their knowledge. To meet this need, context-appropriate planning activities must be selected to support collaborative planning; amendments to the planning process used in the community-based planning initiative are proposed to meet these needs.

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LIST OF ABBREVIATIONS

CBR	Community-Based Research
FN	First Nation
FSL	Full Supply Level
LEK	Local Ecological Knowledge
LSK	Local Social Knowledge
OWC	Oldman Watershed Council
PLWI	Pike Lake Women's Institute
RM	Rural Municipality
SSR	South Saskatchewan River
SWA	Saskatchewan Watershed Authority
SWP	Source Water Protection
TEK	Traditional Ecological Knowledge
WSA	Water Security Agency

1 INTRODUCTION

1.1 Canadian Water Governance

The current approach to water management and governance in Canada is marred by fragmentation, resulting in significant costs, uncertainties, and differential impacts on people, the environment, and watersheds across the nation (Bakker & Cook, 2011). Whether attempting to manage cross-boundary waterways, or commit to standards that match regional or local conditions without sacrificing economic comparative advantages, water governance in Canada is decidedly uncoordinated (Bakker & Cook, 2011; Mitchell, 2005). The different ways that provinces, territories and the federal government interpret their roles and responsibilities in resource management are often influenced by political and economic factors (Bakker & Cook, 2011). Just as these social forces can dominate resource management, so too can different types of knowledge dominate watershed planning (Mukhtarov & Gerlak, 2013).

To engage and empower knowledge types normally excluded from watershed planning will require greater attention to community-based planning (Water Matters Society of Alberta, 2013). A community-based initiative aims to be an "all-inclusive, community-driven process designed to deal with the issues and problems in that watershed" that is "transparent and open to participation by all interested parties in order to build community buy-in and support for the process and the management plan" (Ministry of Environment, Energy & Forestry, n.d., p. 3). The purpose of this research is to identify whether different types of knowledge are present, and explore whether different knowledge types become privileged over others in a community-based watershed planning initiative.

Starting with relatively recent advances in Canadian water management, the Federal Water Policy—finalized in 1987—has acted as a guiding document for water governance. Strategies within the Policy can provide enabling regulations, such as the harmonization of standards for data collection, a means for disseminating information, and the provision of funding for the types of research that would support watershed groups and local decisions on water use and allocation (Environment Canada, 1987). The current impacts of the Policy have been mixed and at times indeterminate, especially with dramatic cuts to programs and agencies that would support the

Policy, leaving water resources leadership in a vacuum (Pearse & Quinn, 1996). The uncoordinated management of the 'edges and boundaries' that characterize Canadian fragmentation (Mitchell, 2005), appearing in the form of departmentalization, can be aggravated or sharpened by the Constitutional separation of powers in Canada (Bakker & Cook, 2011). The results of poor coordination between different levels of government, and stakeholders as well, are evident in the often competing or divergent goals of government ministries and agencies, and conflicts arising due to overlapping jurisdictions, especially between different levels of government (Mitchell, 2005). Uncertainty of rights and responsibilities over water governance are confounded by desires to retain provincial autonomy, as each province attempts to deal with the unique environmental, social, and economic issues related to water management in relative isolation (Bakker & Cook, 2011).

Within this policy environment, water management and watershed planning at all scales vary in process and form across Canada. While national and sub-national agreements exist, there are many examples of "decentralized governance arrangements" that attempt to address context-specific water management issues (Robins, 2007). According to Robins, Provincial governments may provide guidance for these watershed planning and management efforts in the form of planning models or frameworks that incorporate local or regional context as well as principles of integrated water resource management. Although examples vary widely, such principles include stakeholder engagement, an ecosystems approach to management, and a component of economic valuation.

In tandem with the desire to include local context through stakeholder engagement is the push to engage and incorporate multiple 'ways of knowing' into water resources management (Mukhtarov & Gerlak, 2013). Problem identification and definitions can differ significantly between multiple ways of knowing, leading to questions of legitimacy based on how a management "problem" is framed. The integration of multiple and diverse knowledge systems is therefore at the core of resolving problems involving complex systems that are inherently uncertain, and subject to management by stakeholders with diverging values; these are the types of 'wicked problems' that plague water management (Head, 2010). Successful water governance thus depends on finding a way to engage a diverse group of stakeholders, and to integrate the types of knowledge they hold, in order to generate practical and implementable policies (Raymond et al.,

2010). Literature on the importance of including the knowledge embedded in multiple viewpoints, for collaborative planning in general (Innes, 1996) and watershed management specifically (Sabatier et al., 2005), is extensive. While it is increasingly evident that the integration of multiple knowledge types is an important component of water governance, research specifically on the role of knowledge in watershed planning in a Canadian context is limited.

1.2 Purpose and Objectives

The purpose of this thesis is to investigate the different types of knowledge in watershed planning, and explore whether those types of knowledge become privileged. To achieve this goal, three objectives will be met:

1. To identify whether different types of knowledge exist in watershed planning;
2. To determine how different knowledge types affect the watershed planning process;
3. To describe and explain how different knowledge types become privileged in the watershed planning process.

1.3 Knowledge in Watershed Planning

The literature suggests that knowledge types and systems are incorporated into various aspects of management and planning in different ways; the potential contributions of 'non-scientific' knowledge to both resource management and academic pursuits are manifold. An interest in traditional ecological knowledge (TEK) and local ecological knowledge (LEK) by researchers has increased steadily (Davis & Wagner, 2003), especially when discussing the integration of TEK and scientific knowledge in collaborative management, or co-management arrangements (Berkes, 2009; Davis & Ruddle, 2010). Following Raymond et al. (2010, p. 1769), differences between TEK, LEK and scientific knowledge are suggested to be differences in the degree "to which knowledge is embedded in and reflects traditional cultural rules and norms that are derived from many generations of past human-environment interactions." Differentiating between TEK and the long-term accumulation of scientific knowledge thus becomes one of method, articulation, and generalization. TEK has also been explored as: a guide for resource management, and also as a means to foster adaptive capacity in communities responding to regional change (Fernández-Giménez & Fillat Estaque, 2012); a complement to other research methods, such as ground-truthing for remote sensing (Pitt et al., 2012); and to enhance scientific understandings of

complex environmental phenomena and change (Calheiros, Seidl, & Ferreira, 2000; Mustonen, 2013; Olsson & Folke, 2001).

Successful policy formulation is said to require the incorporation of local knowledge, especially when the policies or management decisions are generalized and cannot address place-based physical and social contexts (Bartel, 2013). Ignoring the knowledge held by local landowners can lead to resistance against the application or enforcement of policies, especially if those policies are based on negative assumptions of the knowledge, predisposition, ability of landowners to manage lands, or their stewardship ethics (Rhoads et al., 1999). Water allocation planning also makes use of different types of knowledge, as explored by Taylor & de Loë (2012). Their use of participatory evaluation to assess the role and value of local knowledge in the planning process led to the identification of a variety of knowledge types, and their characteristics, as perceived by stakeholders.

The integration of multiple types of knowledge is often assumed to occur by default through the participatory or deliberative processes of collaborative planning. Such assumptions can jeopardize the success of a planning process, and must be critically assessed. To support rigorous evaluations of knowledge integration, Raymond et al. (2010) devised a conceptual framework for identifying, valuing, integrating, and evaluating local knowledge within a management process. Applying the framework to a multiple case comparison, they found that knowledge is not typically represented by stakeholders in the categories used by academics. Instead, stakeholders used labels such as "farmer, resident, or visitor" to refer to a participant's relationship with the area, since "individuals do not hold merely one type of knowledge" (p. 1772). This finding suggests that the largely academic categories of local, expert, or scientific knowledge are simplistic and should give way to the concept of hybrid knowledge; which represents the outcome of integrating local and scientific knowledge (Reid, Williams, & Paine, 2011). Other approaches to categorizing knowledge exist, but even these approaches must recognize that when researching knowledge integration, "boundaries sometimes can be fuzzy" (Smit, Loë, & Plummer, 2015, p. 441).

Although individuals can hold multiple types of knowledge, it is important to recognize that different types of knowledge are elevated or given preference over others (Agrawal, 1995; Nygren, 1999). According to Robbins (2000, 2006), this privileging of knowledge types is evident in contested natural resource management decisions. In Robbins (2000), four knowledge

groups are classified according to the priorities either of those using the forest, or those in charge of managing it. The author found that these groups generally trend along social classes and education, with some exceptions. From his analysis, Robbins presents an argument against assuming the foundationalism of the outputs of knowledge production, pressing that researchers "cannot afford to discount the constructed nature of *all* stories about the environment, state, local, scientific or otherwise" (Robbins, 2000, p. 142). In Robbins (2006, p. 197), the author includes an account of how local knowledge, as hunter knowledge, is discounted by the environmental community, even though the hunting and environmental communities "share a remarkably similar view on how nature operates and for whom." Thus it is evident that epistemologically different knowledge types (local and scientific/ecological) can be reconciled according to the underlying values and beliefs of those who hold that knowledge.

1.3.1 Local knowledge

Literature on watershed management and planning highlights various aspects of local knowledge, including: how it is conceptualized in terms of space, time, variability, and place; how its validity is assessed; and the role it is seen as serving in the planning process. Presented below is a brief review of those aspects.

1.3.2 Spatiality

Explicit reference to the spatial aspect of local knowledge varies in the literature. Taylor & de Loë (Taylor & Loë, 2012, p. 1212) report that the majority of their participants "related local knowledge to a defined geographic area," using assorted terms to describe how local knowledge can vary with scale. Smit et al. (2015) found their participants referred to the importance of 'knowledge of the watershed', emphasizing the 'local' for knowledge of ecology, politics, and "issues"; how participants understood 'local', beyond references to 'the watershed' or features within it was not explored. Similarly, Raymond et al. (2010, p. 1768) reference "local phenomena," "local site or issue," or "local nuances" but do not delineate what that 'local' frame of reference might represent in geographical terms. Moving away from 'local' while still respecting spatiality, Bartel (2013, p. 893) presents the idea of vernacular knowledge, which is related to local knowledge but modified to acknowledge that the invocation of 'local' "implies a scale which may not be appropriate in all cases." Bartel emphasizes the place-based roots of vernacular knowledge, which aims to account for the unique influences of "biophysical and cultural

heterogeneity" (p. 893) on local, experiential knowledge. The significant relationship between local knowledge and place is explored in greater detail in section 1.3.1.5 below.

1.3.3 Heterogeneity

Bartel's (2013) place-based vernacular knowledge introduces the possibility of variation in local knowledge content by emphasizing the situated nature of knowledge; for Bartel, both the physical setting and dominant culture influence local knowledge. The physical environment, or landscape, of a place influences a person's sense of place, how they experience it, and subsequently, their knowledge of that place (Stedman, 2003). In other words, individuals experience specific areas within a broader, but still local, landscape in a way that can lead to different interpretations of the local landscape, as in the case of land managers such as farmers and ranchers. Exploring knowledge held by ranchers in northwest Colorado, researchers Knapp & Fernández-Giménez (2009) discussed knowledge heterogeneity in terms of "quantity and depth" as measured by the number and type of codes used in their analysis of interviews. Although this analytical approach has limitations stemming from issues with validating knowledge claims, insufficient length of time for interviews, and the "potential difficulty [in] communicating knowledge," their results identify commonalities within heterogeneous expressions of local knowledge (Knapp & Fernández-Giménez, 2009, p. 505). Even if it is expected or seen as inevitable, the presence of differences in local knowledge between individuals can be seen as one of multiple "shortcomings of local knowledge," specifically in its "limited perspective" (Taylor & Loë, 2012, p. 1213). This concern reflects an implicit privileging of a generalized, scientific knowledge that is not 'limited' to "local nuances" (Raymond et al., 2010), even though stakeholders may claim that local knowledge is a valuable component of the planning initiative.

1.3.4 Validity

Concerns of local knowledge validity pertain to critiques of subjectivity, the inconsistent collection of instrumental observations, and the apparent incompatibility of local scale observations with regional climatological or hydrological modelling, or with public policy. Significantly, even "local actors, including non-scientists, share similar reservations towards local knowledge," ostensibly due to "variability in the nature and *quality* of different sources and types of knowledge," understood as a critical differentiation between "anecdotal observations" and instrumental measurement (Taylor & Loë, 2012, p. 1213). Skepticism of locally-based knowledge

claims is also associated with personal association, such that "[t]he legitimacy and value assigned to specific types of knowledge…was strongly linked to familiarity and relationships" between stakeholders (Smit et al., 2015, p. 439). The relationship between knowledge claim evaluations and social standing with peers is a topic that has been of interest in other research disciplines, specifically anthropology and sociology, through the concept of local ecological knowledge (Palmer & Wadley, 2007).

Although not taken from literature on watershed planning, two considerations are relevant when seeking to assess local knowledge validity. The first consideration focuses on research methodology, specifically when identifying expert knowledge holders through 'peer recommendations' (Davis & Wagner, 2003). The second consideration, building from the first, emphasizes the importance of a systematic research design, the operationalization of key concepts (what counts as knowledge, and how are you measuring it?), and a thorough analysis of socio-economic context and associated power relations (Davis & Ruddle, 2010). This context-dependent—or situated—assessment of knowledge claims extends to other factors, such as perceived motivations of local actors, personality characteristics, and prior knowledge bases; these factors can influence how community members evaluate the knowledge claims of other community members, and also how community members *make* knowledge claims (Palmer & Wadley, 2007).

1.3.5 Temporality

As an experiential knowledge, local knowledge is contingent on time for its acquisition and is often "associated…with long-term and on-going experience in a particular area" (Taylor & Loë, 2012, p. 1212). Local knowledge is differentiated from TEK in that local knowledge stems from experience in an area for "a few generations" or less, whereas TEK is understood to encompass multi-generational knowledge and culturally transmitted beliefs (Raymond et al., 2010). While it can be argued that *all* knowledge fits this description, the most significant feature is the origins of TEK as being solely in an indigenous culture. Smit et al. (2015) refer to a 'contextual geographical knowledge' that is linked to time through reference to the historical knowledge of an area, in terms of both the physical environment and social context. Time, as a defining criterion for local knowledge expertise, and space, as a criterion for the "local" attribute of local knowledge, are both factors in defining a participant's relationship with place.

1.3.6 Relationships with place

In writing on the importance of the physical environment in establishing a sense of place, Stedman (2003, p. 672) argues against a purely social construction of place, and for a sense of place that is formed by "the physical setting, as well as human experience and interpretation." Individuals develop a relationship with a place, incorporate that place into their identity, and, through representations of place, associate with others who share a similar place-based identity or set of interests (Hall et al., 2013). This relationship with place can be thought of as a precursor to experiential local knowledge, developing as a result of various human-environment interactions in place over time (Raymond et al., 2010). Similarly, Knapp & Fernández-Giménez (2009) describe a relationship with place stemming from the interactions of land managers with their local environment, a relationship that generates a localized and contextual "rancher knowledge." Repeated interactions between ranchers, their animals, and the environment lead to relationships with place that include intimate knowledge of the local area. The entanglement of time, place, and knowledge is also explored by Rudestam (2014), who finds that the attachment of long-term residents to a landscape can lead them to resist regulatory actions, even if the policies are meant to be protective. The concept of community also factors in to relationships with place. When discussing local social knowledge, Smit et al. (2015) suggest that it is an outcome of some level of activity in the 'local' community, reinforcing the idea that local knowledge is developed through a relationship with place that exists over time. However, when it comes to a planning or management initiative, Reed & McIlveen (2006) highlight the ambiguity of the term 'community'. If left undefined, it will likely become "defined by associative or geographical relations," presenting opportunities for inclusivity as well as exclusivity, depending on existing power relations (Reed & McIlveen, 2006, p. 599).

1.3.7 Role of local knowledge

The role of local knowledge in watershed planning and management is characterized in numerous ways: Calheiros et al. (2000) explored a methodology for integrating local knowledge with scientific knowledge in research on localized water-based phenomena; Semken, Miller, & James (2011) engaged local knowledge to better understand the effects of land use and ecological change over time; Pitt et al. (2012) relied on LEK to supplement remotely-sensed ecosystem identification models; and Mustonen (2013) used oral history to establish an environmental baseline for landscape restoration. Going in to greater detail on the role of local knowledge in

watershed planning, Smit et al. (2015) solicited responses from participants as to the role of different knowledge types in specific parts of a planning process: goal setting, planning, and monitoring. The authors found that various forms of *expert* knowledge were used in all three parts of the process, but local knowledge in particular was limited to the goal setting portion. Taylor & de Loë (2012, p. 1215) also explored the role that participants assigned to local knowledge in watershed planning, finding that it served to critically evaluate "the relevancy, practicality, and implications of proposed measures for affected communities." Furthermore, they found that, in contrast with recommendations from the literature, local knowledge was not valued in the early stages of collaboration; the authors suggest that the prescribed nature of the planning processes in their case studies—as laid out by legislation—may have precluded such considerations. While local knowledge can potentially contribute to watershed planning and management, its role appears to be contingent on supportive public policy, positive stakeholder perceptions of its utility and validity, or the intentional incorporation of local knowledge into research design by researchers.

Knowledge in water management and governance is entwined with many facets of watershed planning, some more obvious than others. With the above review of knowledge in planning and management in mind, the factors in watershed planning that are linked to questions of knowledge and knowledge integration can be understood in context.

1.4 Collaborative Watershed Planning

Collaborative planning is a blanket phrase that covers a wide variety of planning approaches (Forester, 2013; Healey, 1996; Innes, 1995). One of its theoretical roots is found in the literature on organizational behaviour. Generally, collaboration can be conceived as an emergent phenomenon where "a group of autonomous stakeholders of a problem domain engage in an interactive process, using shared rules, norms, and structures, to act or decide on issues related to that domain" (Wood & Gray, 1991, p. 146). An updated definition, drawing on multiple academic disciplines, describes collaboration "as an evolving process whereby two or more social entities actively and reciprocally engage in joint activities aimed at achieving at least one shared goal" (Bedwell et al., 2012, p. 135). Generally, the aim of collaborative planning "is to involve all 'stakeholders' in the processes of planning" in the hopes of "achieving consensual policy outcomes" through inclusive discussions and "debate under the conditions of communicative

action" (Kumar & Paddison, 2000, p. 206). Similar threads of stakeholder involvement, consensus, substantive outcomes, and negotiation, in addition to the devolution of authority, can be seen in the definition of collaborative planning put forward by Cullen et al. (2010, p. 334), who see it as "the delegation of responsibility for planning to stakeholders who engage in interest-based negotiation to reach consensus agreement on plans." (Margerum, 2011, p. 6, emphasis added) states that "[c]ollaboration is an *approach* to solving complex problems in which a diverse group of autonomous stakeholders deliberates to build consensus and develop networks for translating consensus into results." Margerum's (2011, p. 6) point of departure from the organizational behaviour literature is evident in his "[focus] on both solutions and implementation." Collaboration is thus "an approach to planning," with long-term implications, and is "[not] just a process" (Margerum, 2011, p. 6); that is, the planning process is an iterative undertaking that broadly involves the development of solutions to collectively defined problems, and the collaborative implementation of actions to achieve those solutions. Thus, collaborative planning can be seen as striving to equitably integrate knowledge in a way that translates into actionable objectives.

The broad literature on collaborative planning has identified a variety of general constraints in collaborative processes. Some of the factors identified in research on collaborative initiatives include: costs, in terms of transactions (driving to meetings, opportunity costs) and also the distribution of costs as burdens or benefits that result from planning outcomes; capacity and organizational sustainability, with financial, technical, human, legal and social aspects; policy and property rights issues, including the distribution of authority and responsibility; information gaps and limited perspectives, which refers to both data availability and knowledge representation in the process; and adequacy of representation, reflecting on the (in)ability of stakeholders to participate in deliberations (Ananda & Proctor, 2013; Margerum, 2007). The preceding list of factors is not exhaustive, but provides some insight into the complexities involved in collaborative planning. This subsection explores some of these factors, and others, in greater detail with respect to knowledge.

1.4.1 Costs, benefits, and their distribution

For planning, costs can refer to indirect costs incurred by participating in the planning or management initiative through lost opportunities, or generally in the retrieval of information. Costs associated with information retrieval can include opportunity costs in searching for information, actual costs of acquiring data on physical indicators for water management, as well as

costs associated with participation to incorporate various knowledge types into the process (fuel and transportation costs for agency representatives, participants) (Widmark et al., 2013). In other words, the sharing of knowledge in collaborative planning, through attendance at meetings or functions, requires different investments of time and travel by all stakeholder participants (Margerum, 2007). These costs, conceptualized as decision-making costs, can be compared with those of implementation, with the assumption that a relationship exists between "spending" on collaboration and the "costs" of implementing a plan accepted by a community (Roggero, 2013). Although Roggero cautions against the generalization of his findings, collaborative approaches are still seen as capable of "[reducing] transaction costs of cooperation among multiple policy actors" if the distribution of costs is perceived as equitable (Ananda & Proctor, 2013, p. 197). Contrary to these benefits, Lubell, Henry, & McCoy (2010) suggest that collaboration may actually increase transaction costs, as collaboration represents one strategic, rationality-driven game over top of other strategic, rationality-driven games, introducing complexity that individuals must navigate at some (considerable) expense.

1.4.2 Capacity and organizational sustainability

Capacity is defined as the "interaction of human capital, organizational resources, and social capital existing within a given community that can be leveraged to solve collective problems and improve or maintain the well-being of that community" (Chaskin et al. (2001, p. 7), as cited in (Davenport & Seekamp, 2013, p. 1104). Capacity is important not only for long-term or ongoing implementation of a community-based plan, but also for the general undertaking of a collaborative initiative. This is especially salient when the groups are volunteer-based, and rely on either self-raised funds, or inconsistent contributions from different levels of government (Margerum, 2007). Social capital—a reflection of social networks, stakeholder diversity, and a potential indicator of capacity—has been identified as a key factor in effective water management (Plummer & FitzGibbon, 2006).

1.4.3 Policy and rights issues

At the core of this factor are the situations where cross-jurisdictional issues may require extensive time from, and networking by, participants to "seek guidance on basic policy issues," and also where fragmented responsibility and authority inhibit "innovation and flexibility" in governance (Margerum, 2007, p. 141). Other aspects of this factor include issues that pertain to property rights regimes, especially where planning and management involve public and private

lands (Ananda & Proctor, 2013). These issues can relate to vagaries in the definition of property rights, multi-jurisdictional responsibility with little coordination between governments, as well as the rights and responsibilities of private land owners in the disposition of their lands. The involvement of multiple levels of government, as well as a diverse range of individual stakeholders, is necessary to adequately address policy and rights issues that arise in the collaborative planning process; understanding that these stakeholders are interdependent is one of the principles of communicative action, and also of collaborative planning (Booher & Innes, 2002). The selected unit of analysis for the planning initiative is also influenced by property rights and the implications of various policy decisions: delineating an area of interest with lines on a map will draw in or exclude certain agencies and stakeholders, which can lead to questions surrounding the efficacy and legitimacy of governance (Blomquist & Schlager, 2005; Echeverria, 2000; Ferreyra, Loë, & Kreutzwiser, 2008).

1.4.4 Knowledge and power

The interplay between knowledge, its representation through various stakeholders, and the struggle for power and dominance of world views in resource management is complex. Such struggles can reflect a mismatch between what is 'advocated in the literature'—something that resembles a deliberative democracy (Guehlstorf & Hallstrom, 2012)—and the realities of practice in terms of the structure, self-selection of volunteers, and active non-participation in a collaborative planning process (Margerum, 2007). The preference for specific types of knowledge or particular perspectives, if leading to the exclusion of stakeholders from deliberations and discussions in planning, is an expression of power that can be used to achieve underlying ideological desires (Purcell, 2009). Different types of knowledge, when combined with an individual's beliefs and values, leads to divergent views on how, and by whom, a resource should be managed (Robbins, 2000, 2006); Robbins' (2000) analysis suggests that the knowledge of powerful stakeholders generally prevails.

As an example of this power, Ananda & Proctor (2013) identify 'information' gaps in resource management that exist due to the differential flow of resources towards the data collection at specific scales, generally at the national or aggregate as opposed to the fine-grained local scale. The result is implicit support for specific scales of analyses and management, thus reinforcing existing power relationships. Haraway (1988, p. 579) suggests that scientific knowledge, is "the standard for all the translations and conversions" of how society comes to understand and

interpret the world. This privileging of "translation, convertibility, mobility of meanings, and universality" as the standard for knowledge runs counter to Haraway's call for "an earth-wide network of connections, including the ability to partially translate knowledges among very different—and power-differentiated—communities" (Haraway, 1988, p. 580). In other words, different ways of knowing and different types of knowledge are linked to power through the normative or hegemonic privileging of certain types or ways over others; seeking to understand how that privileging takes place, and the potential impact of that privileging, are important steps towards achieving an equitable integration of knowledge in watershed planning. Equity, in this context, refers to the inclusion of participants that represent a variety of knowledge types in all aspects of planning. This does not imply that certain knowledge types cannot be more useful in certain parts of the process, but such a recognition does not give license to exclude those participants and their contributions based on the way they interpret the world and the knowledge they hold.

To achieve a common understanding or definition of the issues to be addressed in a planning initiative, it is vital to have stakeholders with diverse experiences, interests, values, and resources at the table; especially important is the inclusion of *local knowledge* in discussions and deliberations (Booher & Innes, 2002; Healey, 1996). Collaborative planning aims to bring stakeholders together to engender common values and management goals within a community. If integrating multiple types of knowledge is necessary for collaboration, what are those types, and what place do they have in planning? Does this integration address the power struggles associated with different knowledge types? Moving from knowledge to action, Booher & Innes (2002) argue that different types of power can be used to effect changes that lead to a more democratic representation of knowledge.

1.4.5 Representation and participation

It is clear that with broad representation of stakeholders--including government agency representatives--comes a set of backgrounds, vocations, and academic training that is contextually diverse and thus not subject to a rigidly defined planning process (Smit et al., 2015). With that diversity, participants, facilitators, and researchers alike must avoid assuming that participants in a collaborative process have an inherent ability to participate in deliberative discussions (Ashwood et al., 2014). Looking deeper into diversity in representation, Reed & McIlveen (2006) speak to the importance of critically assessing the actual diversity amongst committee

members on a resource management board. Their concern is that prior experience or expertise in management may end up "constraining [the] participation" of other stakeholders. For example, committee members in positions of power may have "access to resources and negotiation experience" that enables them to manipulate the process, or that their position or experience may actually compromise their claims of being representative of the people or stakeholders they purportedly represent (Reed & McIlveen, 2006, p. 601). Stakeholder representation, in this situation, then becomes a constraint to equitable participation in watershed planning and management. Guehlstorf & Hallstrom (2012) emphasize the importance of community engagement throughout the entire process, and in all aspects of watershed planning and management. Their study on wetland management in Nova Scotia highlights the need for democratic decision-making in community-based resource management, especially in a political reality characterized by the gradual but continuous retreat of higher levels of government from a "command-and-control" approach to management.

1.4.6 Consensus

Taking a practical stance on consensus, Margerum, p. (2011, p. 7) defines it as a set of "decision rules ranging from complete agreement to a simple majority, but in most cases it means an agreement that everyone can live with." In terms of decision-making, the process of *consensus building* is seen as more important than simply achieving consensus on an action item (Innes, 2004). Consensus building occurs when "individuals come together, share information, and reach a mutual agreement about problems, goals, and actions" (Margerum, 2011, p. 8). Both Innes and Margerum differentiate consensus building from collaboration, with Margerum (2011, p. 8) framing it as "the planning phase of collaboration" while Innes (2004, p. 7) describes it as a method of practice that: relies on inclusion of stakeholders; focuses on a meaningful task; has terms of reference set by participants; "avoids positional bargaining"; is conducted with equitable dialogue and participation; is reflective and "unconstrained" in time and content; does not restrict access to information; and achieves consensus through exhaustive exploration of interests and concerns. Knowing the difference between the process of consensus building and the outcomes of reaching a consensus on issues can influence how a stakeholder chooses to participate in the planning initiative.

While the practice of consensus building as a *practice* to achieve decision-making by consensus may provide opportunities for deliberative engagement and increase the perceived legitimacy of the planning process, aiming for consensus may also negatively impact the process. In their research on an inactive watershed group, Rudeen et al. (2012, p. 1023) concluded that, although "consensus seeking lent legitimacy to the process," it also led to participants setting "unrealistic expectations and ultimately disappointment and disillusionment among participants when agreement was not reached"; one long term implication of the perceived failure was the self-exclusion of participants from engagement in "future collaborative efforts." The authors point to the difficulties in evaluating success in consensus-based collaborative efforts, especially if participants' unchanging "interests and underlying values" restrict the achievement of the "sense of interdependence" considered necessary for deliberation (Healey, 1996). Acknowledging that "subjective and objective criteria for success" of a process may be met without achieving consensus, Rudeen et al. (2012, p. 1016) highlight the potential decoupling of process outcomes, such as relationship building and learning, from process outputs, such as a finalized plan that stakeholders agree to.

Another perspective on consensus considers the potential influence of decision-making style on the implementation of management actions. Roggero (2013) explores this relationship through an economic lens, focusing on how process designs make trade-offs between decision-making costs and implementation costs. The author developed and applied an analytical model of decision-making to examples of "participatory water governance" in Germany, conducted under guidelines set out by the European Union. Roggero's findings suggest that, for the case studies considered, "[p]articipation does not seem to be about truly deciding together" (Roggero, 2013, p. 72). Preference for a process design that seeks to reduce decision-making costs can ultimately "[constrain] representation" (Reed & McIlveen, 2006), where opposition to management proposals by stakeholders increases overall implementation costs.

1.4.7 Evaluation

Evaluation of collaborative efforts has gained the attention of researchers in environmental management and planning (Gunton, Rutherford, et al., 2006). Evaluation is described by Carol Weiss as "the systematic assessment of the operation and/or the outcomes of a program or policy, compared to a set of explicit or implicit standards, as a means of contributing to the improvement of the program or policy" (Wiess, (1998) in (Gunton, Rutherford, et al., 2006, p. 2).

Margerum (2011) describes six approaches to evaluation, with a focus on: evaluating the inputs to the planning process, the quality of the process itself, assessment of the plan or agreement quality, measures of performance, reports of actual outcome conditions, and an evaluation of linkages between outputs and outcomes. While some planning systems have mandated evaluative components, those without a requirement for assessment may be informally assessed by planning participants based on arbitrary indicators with undeclared or unrecognized assumptions (Gunton, Rutherford, et al., 2006).

Process and outcome indicators have been used to evaluate collaboration in resource management (Gunton, Peter, & Day, 2006). This focus on process and outcomes is based on the assumption that "[i]mproving the process of decision making will produce better products and results" and that the "[m]onitoring of actual results [is] important for determining [the] success of efforts" (Margerum, 2011, p. 275). Evaluation can relate to both environmental and social outcomes, with "success…defined in terms of process (inclusiveness, fairness, and legitimacy), outputs (agreements, plans, activities), and outcomes (changed social, economic, and ecological conditions)" (Rudeen et al., 2012, p. 1015). Taylor, de Loë, & Bjornlund (2013, p. 43) argue that evaluation can provide "insight into what [collaborative processes] can and cannot achieve, or how the process of knowledge production should be structured and run." The authors propose three process characteristics (effective communication among participants, participation by relevant and affected interests, joint fact finding) and two outcome characteristics (understanding and acceptance of knowledge among participants, enhanced civic trust and engagement), with sets of criteria, that can be used to evaluate the success of knowledge production in collaboration (Taylor et al., 2013).

1.4.8 Summary

A collaborative approach to planning offers many opportunities to build relationships between stakeholders, and can assist in sharing and valuing alternative ways of knowing. While there are many factors that may negatively or positively influence the success of the planning process, the importance of having a diverse knowledge base is recognized both in theory and practice. Research on knowledge in resource management has reinforced the importance of equitable integration and has described methodological considerations that can support the elevation of alternative ways of knowing in resource management generally. Research on knowledge in

watershed planning has revealed similar findings, but exploration of the types of knowledge involved and how they are engaged in a Canadian context is nascent. It is from this understanding of the state of watershed planning that my research commences.

1.5 Research Context

1.5.1 In Canada

Concerns about inclusion and exclusion of stakeholders extend to watershed planning in Canada. From their review of participatory management literature, Guehlstorf & Hallstrom (2012, p. 145) caution that "[j]ust because a party is present does not mean their voice is being heard and, more importantly, integrated into the decision-making process." Although not based in Canada, Ashwood et al. (2014, pp. 429–30) echo this caution and advise that researchers should not "[assume] that if a person knows 'locally,' a person knows in ways friendly to deliberation" and that "using participation rates and attendance as measures of the exchange of knowledge" is a flawed approach. Smit et al. (2015) assess knowledge integration in watershed planning in New Brunswick, focusing on the goal-setting, planning, and monitoring components of collaborative planning. Their results reinforce the cautions against assuming that knowledge integration in participatory or collaborative processes is unproblematic.

In Canada, watershed planning is generally performed under a provincial framework. As evident in Alberta's *Water Act* (Wenig, 2010), these frameworks may not provide clear guidance on how to include different types of knowledge in the planning process. Although requirements related to the participation of stakeholders are left broad and voluntary, Wenig (2010, p. 9) concludes that the *Act* "[stresses] the value of local participation and of integrative management approaches." An example of how local organizations are able to use the loose guidance in a constructive manner can be found in the Oldman Basin, Alberta. The Headwaters Action Plan, initiated by the Oldman Watershed Council (OWC), included workshops from which "local knowledge…informed OWC's action planning" to such a degree that the participants perceived the "linking of local knowledge and expertise with science research…[as] a fruitful learning opportunity for all involved" (Water Matters Society of Alberta, 2013, p. 3). While the explicit goal of integrating local knowledge into watershed management is laudable, the OWC example appears to be isolated.

Guidance for the systematic knowledge integration in plan-making is also missing from non-government policy reports, including the Prairie Water Directive (Maas & Telfer, n.d.). The Directive states that "Indigenous and local knowledge should be integrated into knowledge-gathering exercises and should influence governmental decision-making" (Maas & Telfer, n.d., p. 37), but does not provide a framework to gather, evaluate, and incorporate either type of knowledge into decision-making. A similar issue can be found with academic policy reports, such as *A Blueprint for Watershed Governance in British Columbia*:

> In the scholarly reviews, it is generally recognized that new modes of governance require new ways of knowledge generation and management. Including a broader set of stakeholders provides access to different kinds of knowledge, which may be vital for a full assessment of a resource governance problem and for finding innovative and adaptive solutions (Brandes et al., 2014, p. 32).

Although the roles of different knowledge types are recognized as important, the *Blueprint* lacks a blueprint on how to integrate that knowledge. Claims might be made that integration is simply an issue of technique or method in terms of community engagement, but as the arguments presented previously suggests, these are not reliable or appropriate claims (Smit et al., 2015).

1.5.2 In Saskatchewan

In Saskatchewan, the Water Security Agency (WSA; formerly the Saskatchewan Watershed Authority [SWA]), has a comprehensive mandate focusing on the management of water and "related land resources" ("The Water Security Agency Act," 2013, p. 6). Water management is organized according to "geographically-defined watersheds," with a focus on source water protection (SWP) (Saskatchewan Watershed Authority, n.d.). The WSA has also developed a watershed planning model that "is designed to achieve consensus, collaboration and stakeholder involvement throughout the process" (SWA, n.d., p. 2). Most of the watershed plans completed in Saskatchewan are focused on SWP, but as the model provided by the WSA is not specific to SWP, it seen as useful for a range of applications. The model first outlines the organizational structure of a watershed advisory committee, which includes a technical committee and a planning team. The technical committee is charged with the "assembly and analysis of information" and is comprised of technical experts as "agency representatives specializing in natural resource management" (p. 4). Stakeholder participation in the planning process is described as vital, yet the knowledge held by local residents is isolated to a "thorough discussion of the issues" to be

dealt with by the advisory committee; such local knowledge is then "supplemented by technical input" from the panel of experts on the technical committee (p. 6).

While the model provides a framework for watershed planning, it does not prescribe activities or methods to elicit, interrogate, and incorporate the knowledge held by the diverse group of people expected to participate in the advisory committee. The WSA acknowledges that the model is only appropriate for certain scales of analysis and management; it may not be applicable in all contexts, although the document only references circumstances where the coordination of stakeholders is complicated by an expansive geographical extent of the watershed under consideration. At a smaller scale of watershed management, stakeholders can come together to plan for an area not easily defined by geographical boundaries. Lacking guidance from the WSA in the form of a planning model at such a scale, community members and water management stakeholders must seek out alternative forms of planning and management. One goal of this research is to focus on a community-based planning initiative to explore the usefulness of an explicit focus on knowledge in watershed planning.

1.6 Organization of chapters

Following this introductory chapter, chapter three describes the research methods, chapter three presents the research results, the fourth chapter discusses the research findings, and the fifth chapter provides a conclusion and recommendations from the research. References cited and appendices follow in the final chapter.

2 RESEARCH METHODS

2.1 Study Area

The body of water known as Pike Lake, Saskatchewan is located approximately 30 km south-south-east of Saskatoon, Saskatchewan, in the flood plain of the South Saskatchewan River (SSR). Pike Lake is surrounded by grass- and pasture-lands, residential acreages and developments, cottages, and Pike Lake Provincial Park (Figure 2.1). The Pike Lake community includes a school (kindergarten to grade 4), family farming operations around the lake (up to approximately 3,000 acres), year-round cottages in the Provincial Park, and year-round residential housing in the surrounding area. During the summer, the Park and community provide services to support high levels of recreational traffic, which includes seasonal users with cabins, overnight campers, and day-users of the lake, swimming pool, and golfing facilities.

Members from the community approached my advisor for assistance with a watershed plan. This provided an opportunity for me to observe the initial undertakings and develop the research purpose. For research into knowledge in watershed planning, Pike Lake provides an excellent research site given the variety of stakeholders that arise due to its proximity to an urban centre, the dominant resource-focused land use surrounding the lake, the presence of a cottaging community, and both internal and external economic development pressures. The type and status of the planning initiative also provided the opportunity to participate from the beginning. Those involved in the initiative are aiming for an inclusive and participatory process, and seek to address the diverse concerns held by the numerous stakeholders who work, farm, live, and recreate in the area. Stakeholders have a wide variety of concerns, some of which include fluctuating water levels in the lake and on surrounding lands, nutrient enrichment of the lake, and habitat loss in riparian areas. The diverse cross-section of stakeholders provided an opportunity to investigate how a collaborative, community-based planning process supports or constrains knowledge integration in watershed planning.

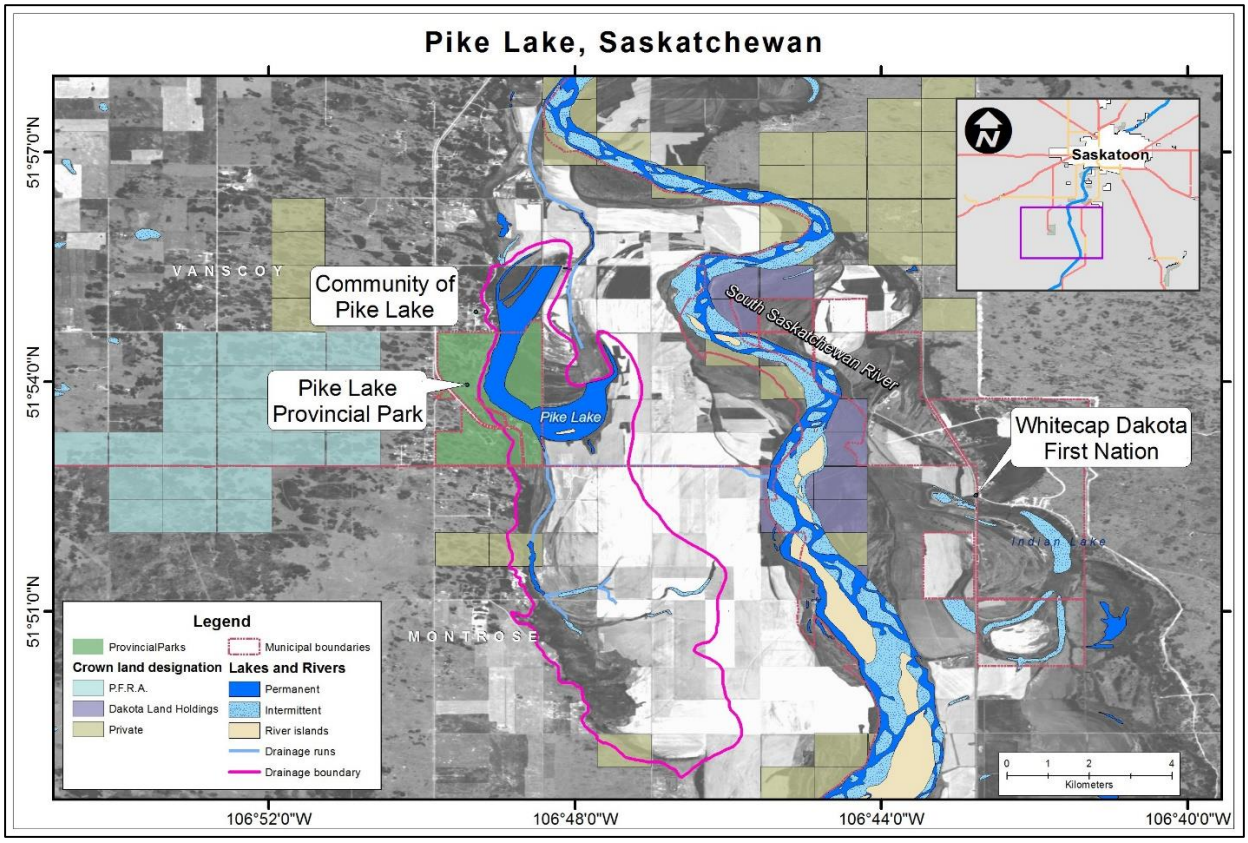


Figure 2.1: Satellite imagery of Pike Lake, Saskatchewan.
Note: Map generated by Warrick Baijius [2015]. (G. Hagen, pers. comm., 2014; Information Services Corporation [Park boundaries, RM boundaries, UM boundaries], 2014; Saskatchewan Ministry of Agriculture, 2014; Natural Resources Canada (NRC), 2014; NRC, 2010; NRC [National Hydro Network, orthoimage], 2007; Saskatchewan Ministry of Highways and Infrastructure, 2013).

2.1.1 First Nations

The closest First Nation (FN) to Pike Lake is that of Whitecap Dakota (see Figure 2.1). The Whitecap Dakota FN is a member of the Saskatoon Tribal Council, which represents the FN in the Federation of Saskatchewan Indian Nations (Saskatoon Tribal Council, 2015); Whitecap Dakota is a non-treaty Nation that is currently in self-government negotiations with the Government of Canada (Aboriginal Affairs and Northern Development Canada [AANDC], n.d.). According to AANDC (n.d.), Whitecap Dakota FN has "over 600 members living both on- and off-reserve, as well as about 180 non-members living on reserve."

Although references to FN peoples making use of the land and resources in and around Pike Lake prior to and during European settlement are presented below, Whitecap Dakota FN is

not represented as a stakeholder in this planning process. The original process for selecting committee members focused on government agencies, local government representatives, and community members that would be directly affected by management actions (i.e. land owners and residents). The initial watershed 'boundaries' referenced by the PLCWA also excluded residents and farmers living above the ridge of the flood plain, even though this land is understood to be hydraulically connected to the Lake through groundwater. The traditional knowledge of the area held by FN peoples, and the historical knowledge of long-term (homesteading) residents in the area above the floodplain, were thus not included in the first iteration of the planning process.

Since the planning process was initiated by community members rather than the Provincial or local governments, engagement of First Nations regarding resource rights—at this point in time—is voluntary (Government of Saskatchewan, 2010). However, depending on action items in the final plan, the voluntary engagement may become mandatory if a Provincial agency or Ministry is to take specific action. According to the Saskatchewan Ministry of Government Relations:

> When a proponent submits a project proposal to government for authorization, government will assess whether the project triggers the duty to consult. Where the duty to consult is triggered, government has an obligation to ensure First Nations and Métis communities are appropriately consulted and accommodated in accordance with the CPF in advance of issuing authorizations. (Ministry of Government Relations, 2013, p. 3)

For the duration of this research, there were no representatives from the FN at the meetings. While not reflected in the minutes, there have been discussions about expanding the stakeholder group to include Whitecap Dakota FN in the planning process. However, two considerations are important when considering the potential impact of TEK on this planning process: this area is not within the traditional range of pre-settlement Whitecap Dakota peoples, so their contributions of TEK pertinent to Pike Lake may be limited; and the specific concerns and constrained area under consideration in the planning process may be less aligned with the broad or regional knowledge base typically associated with TEK.

2.1.2 Recent history

Some of the recent history of Pike Lake has been captured in two locally published works, assembled by residents of the area (Pike Lake Women's Institute, 1981; Pippin, 1981) . The historical accounts extend back in time beyond the phase of homesteading settlement, and

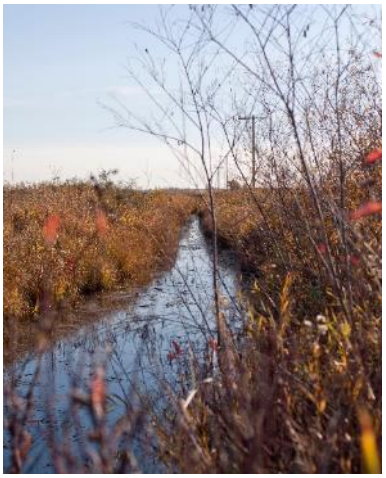
includes mention of how First Nations peoples relied on the area and its resources, including as hunting and trapping grounds, for food and medicinal gathering, and as a base camp (Pippin, 1981). European settlement, as homesteading, increased in the tail end of the 1800's and early in the 1900's. Trapping and hunting for pelts helped homesteaders through "tough times" while farming, as did the presence of fish after flooding of the SSR. Pike Lake has been seen as a recreational destination since at least 1909, when "people were starting to use Pike Lake as a summer resort and a place to hold picnics" (Pippin, 1981, p. 62). The Provincial government, through the Department of Natural Resources, purchased land surrounding the lake through the end of the 1950's to establish a park (PLWI, 1981). Prior to this conversion, local residents had already invested time, effort, and materials to create a recreational area and buildings that supported a variety of activities for the community (Pippin, 1981).

The hydrology of Pike Lake is dependent on both local and regional climate conditions. Local rains and snow melt recharge aquifers above the floodplain, which feed in to the lake directly or through the south creek (Pippin, 1981); river levels, dependent on snow pack in the Rocky Mountains, are either high enough to lead to ponding or flooding of farm land in the flood plain, or are low enough, in conjunction with local drought, to result in significant reductions in the volume of water in Pike Lake. Historically, ice jams have also been a significant cause of flooding during spring thaw (Pippin, 1981). Since the construction of the Gardiner Dam/Coteau Creek/Diefenbaker Lake hydroelectric complex, Pike Lake has not seen flooding as significant as that experienced prior to the change in the river flow regime. To address the issues of lake levels dropping due to drought, the Province began pumping water into the lake; the practice continues not only for the purpose of maintaining recreational use of the lake, but also to support the irrigation of farm land.

Two attempts at setting up a pump site and canal preceded the current pump site and canal. The first site was set up by the federal Prairie Farm Rehabilitation Administration, with the intention of pumping water into Pike Lake from the SSR; according to the Pike Lake Women's Institute (1981, p. 79), "in so far as carrying water to the Lake the project was a failure"; the second attempt was to focus on supplying water for irrigation, but "rains and flooding in successive years hampered efforts." As of October 2014, a permanent building and pumping system was to be installed at the current pump site, replacing the previous system (see Figure 2.2) in which the pumps were lowered into or removed from the river by a crane truck.

(a) Intake manifold for pumps, on the west bank of the South Saskatchewan River, viewing north.

(b) Outflow of the pump system, head of the canal, viewing east.



(c) End of the canal, south end of the park boundary, viewing east.

Figure 2.2: Infrastructure for filling Pike Lake from the South Saskatchewan River
Note: Photos taken by Warrick Baijius [October 2014].

With expanded human settlement and increased use of the lake and surrounding area have come changes in the local ecosystem. Land was cleared and broken for farming and grazing, and non-native trees were planted in recreational areas. At one point the lake was drained, by connecting the lake to an existing channel (see Figure 2.3 and Figure 2.4), in order to scrape clear and sand the bottom; remnants from an application of pesticides used to control weeds also killed off fish after refilling and restocking the lake (PLWI, 1981). Historical fire disturbance regimes have also been altered, though Pippin (1981, p. 137) suggests that through the 20th century, arson was at the root of an increase in fire disturbance: "There was a man who was suspected of starting many of these fires and perhaps the suspicion was right for after he passed away, the number of fires decreased considerably." Prior to the completion of the Gardiner Dam complex in 1967 (Smith & Kells, 1993, p. 504), June floods would typically replenish the Lake with water and fish, including pike (*Esox lucius*) and goldeye (*Hiodon alosoides*) (PLWI, 1981, p. 60).

The rich social history, complex hydrology, and predominantly agricultural land use in the area has established strong influences on the interests, values, and perceptions of how both land and water *should* be managed in the Pike Lake area. Pressures from the rapidly expanding

City of Saskatoon include increased recreational traffic and use of the Park, but also pressures to change land use to accommodate exurban migrants. Much treasured by long-term residents, the rural way of life in Pike Lake is a powerful draw of people wanting to experience life in a 'natural' setting while maintaining a connection with the services and amenities of a large city.

Through a collaborative, community-based planning initiative, the water management stakeholders in Pike Lake are searching for common ground in a social, economic, and environmental landscape subject to constant, and occasionally rapid, change. As stakeholders engage with each other and the surrounding environment, different knowledge types and content are employed to achieve certain ends. This research seeks to understand how a community-based planning process influences the expression and valuing of knowledge in a context marked by uncertainty.

(a) Drainage intake at the north end of Pike Lake, viewing northwest.

(b) Weir/dam for outflow at the north end of Pike Lake, viewing east.

Figure 2.3: Infrastructure used to release water from the north end of Pike Lake

Note: Photos taken by Warrick Baijius [October 2014]

(a) Drainage channel and new culverts to the north of Pike Lake, viewing south.

(b) Drainage channel and new culverts, viewing north.

Figure 2.4: Drainage channel from Pike Lake to the South Saskatchewan River
Note: Photos taken by Warrick Baijius [October 2014].

2.2 Approach

The purpose of this thesis is to describe the different knowledge types in watershed planning, and to identify whether specific knowledge types become privileged over others. To do so, I approach this research from a constructivist perspective. Social constructivism creates space for the "subjective meanings of…experiences" to exist, forming the basis of the different perceptions of knowledge that are of interest in this research (Creswell, 2003, p. 9). This approach allowed me to focus on the individual perceptions and interpretations of the knowledge involved in watershed planning. I also follow a conceptual approach to knowledge, as opposed to a definitional approach. Whereas "the definitional approach treats complex processes and [phenomena] as self-evident and socio-culturally simple," a conceptual approach allows for "knowledge systems [that] are dynamic within their cultural and political contexts wherein knowing and truth are variable, and frequently contested" (Davis & Ruddle, 2010, pp. 885–6). I argue from the position

that knowledge is socially constructed and its expression is influenced by context. Thus, research focused on identifying knowledge and explaining its influence in a planning process requires in-depth engagement with participants in the process in order to uncover the potentially differing interpretations of knowledge, its role in the process, and the contexts in which it is accumulated and expressed.

2.3 Community-Based Research

Community-based research (CBR) provides a frame for this research: "CBR's central objectives are to involve community members in respectful ways and to ensure that direct community benefits flow from the research process" (Markey, Halseth, & Manson, 2010, p. 161). Participation in the plan-making activities, similar to Plummer's (2006) action research in Ontario watersheds, extends the focus of this research beyond the substantive outcome of enhancing knowledge integration in the planning process. Many of the stakeholders in the planning initiative are or will be directly impacted by the way the planning process handles flows of knowledge and interactions by participants. Conceptually, different types of knowledge can be given a voice in the planning process through stakeholders (Stewart, Glover, & Barkley, 2013), who relay individual experiences that are linked to specific times and places.

By discussing knowledge in terms of power, it can and has been argued that attempts to integrate different forms of knowledge into planning act as emancipatory actions (Davis & Wagner, 2003), further aligning this research with the objectives of CBR. In a research context, emancipatory actions can be seen as an attempt to "empower the poor and oppressed in society" by striving to "democratize the production of knowledge and build capacity" (Ferreyra, 2006, p. 579). In its focus on understanding knowledge flows in a planning process, this research aims to support the refinement of a planning model in order to empower and include different knowledge types in watershed planning.

While my research focuses on participants within the planning process and the interactions between them, it is separate from the process. The Pike Lake planning initiative is on-going and iterative, while the research is constrained to the initial portion of the process in which the majority of knowledge integration is expected to take place.

2.3.1 Observation

Direct observation allows the researcher to experience comments, conversations, and general attitudes of meeting participants; these interactions can escape record in meeting minutes and other substantive documents (Bernard, 2000). Observation of the planning process, in conjunction with assisting facilitation, aided in my understanding of issues at hand in the planning initiative, and guided the development of the research purpose and objectives. By assisting in the facilitation of the watershed planning process, I am situated as an *observer as participant* (Glesne, 2010). Participation provides an opportunity to build trust and rapport with committee members (Arksey & Knight, 1999); these committee members provided the data for this research through participation in interviews. Such trust-building is expected to enhance the reliability and quality of responses to interview questions (Bernard, 2000).

2.3.2 Planning model

The planning model agreed to by stakeholders in the Pike Lake initiative is based on the SWP planning model presented by Aboriginal Affairs and Northern Development Canada (2013). Although the original model focuses on SWP for on-reserve First Nations, the original author of the model (R. Patrick) provided Pike Lake stakeholders with a modified version that maintained the core structure and activities of the original while incorporating changes that enable a more generalized application (see Figure 2.5 and Appendix B: ; R. Patrick, personal communication, November 17, 2013). This cyclical, five-stage model is intended to function as a forum for representative democratic processes that focus on watershed planning and management. In Stage 1, a working committee is established, and is expected to be composed of a diverse set of stakeholders; also in this stage is the "[identification of] goals and objectives of the future watershed plan." The committee then addresses Stage 2, which involves the assessment of "watershed characteristics" and the "[identification of] issues and concerns from all stakeholders." Stage 3 involves the identification and discussion of management actions, Stage 4 the development of an implementation strategy, and Stage 5 a general review of the plan (and updating if it is a subsequent cycle); major changes are first vetted through public engagement. This research included observation of pre-planning activities, Stages 1 through 4, with interviews conducted towards the end of Stage 3. While the stages are shown to be distinct, they often overlap; actions are revisited, assessments are revised, and the composition of the working committee changes.

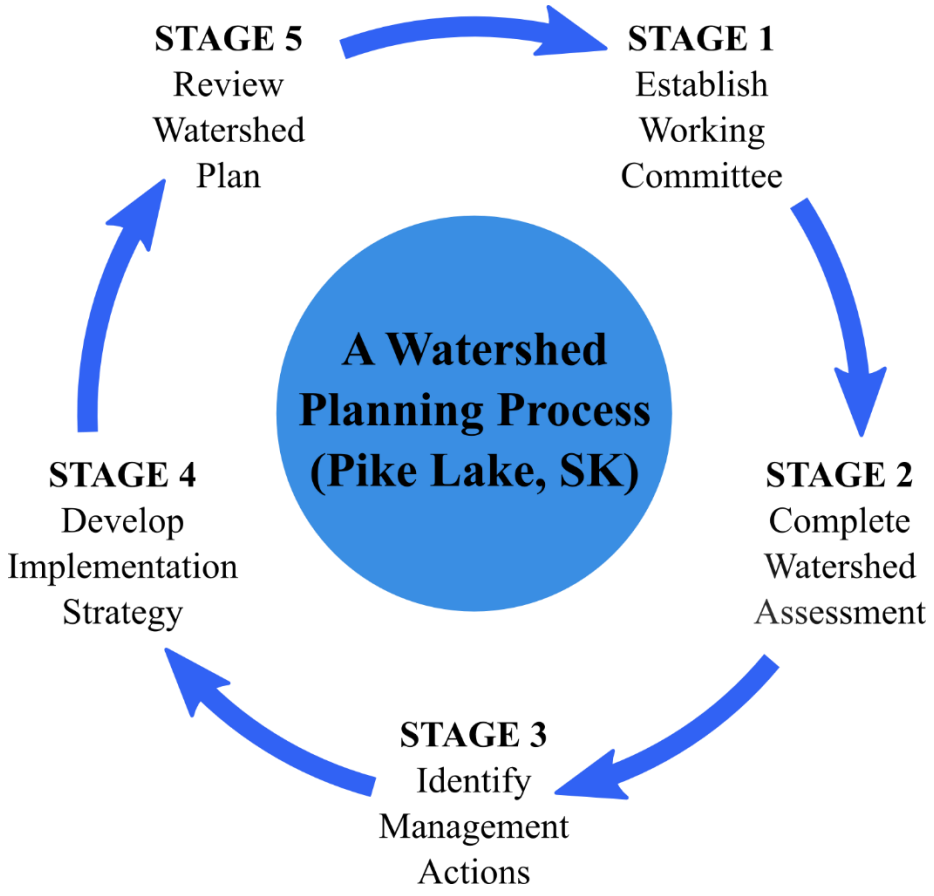


Figure 2.5: Planning model for Pike Lake.

Note: Redrawn from Aboriginal Affairs and Northern Development Canada (2013) by R. Patrick (Personal communication); see Appendix B for more information.

2.4 Literature Review

Objective #1 is to identify whether different types of knowledge exist in watershed planning. The primary method used to fulfil this objective was a literature review. A literature review establishes what has already been researched on a topic, as well as helps to identify gaps and avenues for future research (Bernard, 2000). Academic articles, retrieved through online databases such as Web of Science © and SCOPUS ©, provided a framework for the identification and description of knowledge types, as well as a conceptual basis of how those knowledge types interact and influence the planning process (see Section 2.6 for further explanation).

2.5 Semi-Structured Interviews

Objective #2 seeks to clarify how different knowledge types affect the planning process, and Objective #3 to describe how some of those different knowledge types can become privileged over others. In partial fulfilment of these objectives, primary data collection was conducted with semi-structured interviews aided by an interview guide with open and closed questions (see Appendix A:); a University ethics waiver was received on October 17, 2013. Interviews are recognized as capable of "[collecting] a diversity of meaning, opinion, and experiences" (Dunn, 2010, p. 102), while the use of interview guides assists in collecting "reliable, comparable qualitative data" from multiple interviews (Bernard, 2000, p. 191). Comparability was desirable to identify commonalities and differences between stakeholder perceptions of knowledge types.

Closed questions were chosen to gather background information from participants (Glesne, 2010), such as their relationship with the surrounding area (resident, farmer, park employee, etc.), length of that relationship, employment, and general level of education. Responses to these questions revealed linkages between that information and perceptions related to knowledge types in the planning process. Open-ended questions were used to "[discover] what is relevant to the informant" (Dunn, 2010, p. 103), either through the phrasing of the question itself, or through probing for further responses (Bernard, 2000). The goal of the interviews was to leave interpretation of knowledge types to the respondent, rather than imposing predefined knowledge categories (Davis & Ruddle, 2010). It is important that responses to these open-ended interview questions be considered in context, as Palmer & Wadley (2007, p. 749) caution that "[w]hat is said about a particular subject is not necessarily what is known about it, and vice versa." They emphasize that "talk [is] a means of influencing other people," and that stakeholders are "active agents who use talk about the environment to help shape perhaps the most important part of that environment—the behavior of humans" (p. 750). While Palmer & Wadley were focused on clarifying local ecological knowledge from local ecological talk, their warning applies to the expression of any knowledge in a planning or management scenario.

All interviews but one were conducted one-to-one, with the aim of reducing the possibility of external influence, and also to keep the interviews focused. Interviews were digitally recorded and transcribed manually. Each participant received a copy of their own transcript for vetting, and to enhance the accuracy of transcription (Dunn, 2010). It also afforded the participants an opportunity to "reflect on their answers: remembering triggers further memories"

(George & Stratford, 2010, p. 145); in this way, member reflections can "enhance qualitative credibility" (Tracy, 2010, p. 844). Member checking is an ethical consideration, and can lead to significant changes in research results. In conjunction with high levels of trust developed throughout CBR, member checking can also lead to retractions of interviews. As experienced in this research, the "pool of participants" was a subset of an already "small local population" (Markey et al., 2010, p. 170). Retractions occurred over concerns of anonymity and representation; that the retractions were made *after* participants received their transcripts for review may indicate that those participants felt that they over-shared due to the level of trust that had developed between us. While Markey et al. (2010) acknowledge that member checking may alter findings, they do not address the concern of significant loss of data through retractions. See Table 3.1 for more information on the results of member reflections.

Beyond generally supporting the analysis, sentences, phrases, and words from the transcribed interviews provide details for concepts presented in the results section, and support findings in the analysis. These shorter citations aim to capture subtle variations in the way knowledge is perceived or conceptualized by participants. Longer citations are also used to achieve "[t]hick descriptions [that] capture and record the voices of lived experiences" as a way to truthfully represent the experiences of stakeholders in the planning process and the types of knowledge that they hold (Denzin, 2001, p. 99).

2.5.1 Sampling

As the research focused on the Pike Lake planning process specifically, sampling was restricted to the committee members of the process. I solicited participation by emailing an interview request to all committee members. This is a mix of opportunistic sampling, due to their current involvement in the planning process, and maximum variation sampling, due to their representation of a variety of stakeholder groups in the broader geographical area (Glesne, 2010).

Stakeholder groups include farmers, property owners, cottage owners, and local and provincial governments and agencies, providing a diverse cross-section (see Table 3.1). The initial number of interviews was 11 (including one interview with two participants); at the time, this represented the entire committee. Two interviews were retracted; see the section above for a discussion about the retractions.

2.5.2 Document review

Much like having a grasp of the research topic (Arksey & Knight, 1999), learning about the local history of an area in preparation for an interview allows for probing of relevant topics that arise in the interview, and also build trust with the interviewee by showing that the researcher is prepared and interested. As there has been limited published academic research on the Pike Lake area, self-published books—including the Pike Lake Women's Institute's (1981) *Reflections: Pike Lake, Valley Park* and John Ralph Pippin's (1981) *Seventy Years in Saskatchewan on Mud Snakes and Sauerkraut*—can provide detailed social histories that are not otherwise captured. These books also stand as references for triangulating knowledge claims, and provide historical context that captures experiences beyond those represented in the planning process. Another potential source that can provide a view of historical conditions is aerial photography; while photographs of the area exist, they are currently being processed by library staff at the University of Saskatchewan, and are inaccessible to the public.

2.6 Data Analysis

Analysis followed the inductive approach of interpretive description (Thorne, Kirkham, & O'Flynn-Magee, 2004), a type of general qualitative inquiry that provides flexibility in its use of methods borrowed from established qualitative methodologies such as phenomenology, ethnography, and grounded theory (Caelli, Ray, & Mill, 2003; Kahlke, 2014). According to Thorne et al. (2004, p. 4), the object of interpretive description is to develop "a coherent conceptual description that taps thematic patterns and commonalities believed to characterize the phenomenon that is being studied and also accounts for the individual variations within them." Thus, a thematic analysis of the data was undertaken. An initial set of themes identified from the literature review was used to develop an analytic framework; themes were identified through manifest content analysis, based on the explicit mention of different knowledge types and identified factors in watershed planning.

Transcription of the interviews provided an opportunity to engage in preliminary coding. Initial coding involved "searching through the data for themes and patterns" (Glesne, 2010, p. 187). Further coding was then used to refine the analytic framework; this was undertaken at the line-by-line level, and also at the topic or question level to allow for broader pattern recognition (Thorne et al., 2004). Subsequent iterations of coding grouped the initial codes, and coding of

larger sections helped to find "groups of data bearing similar characteristics [that could be] be examined and re-examined for a range of alternatives" (Thorne et al., 2004, p. 5). This approach is similar to that of Smit et al. (2015), who also made use of initial categories from the literature to guide their inquiry into watershed planning. The transcribing software used was TranslatorAG (http://translatorag.sourceforge.net/); coding was performed using the R package for Qualitative Data Analysis [RQDA] (Huang, 2014).

A significant concern acknowledged in qualitative research is the presence of "disciplinary assumptions and theoretical perspectives" embedded in analysis (Charmaz, 2003, p. 319). In other words, the concern is that a researcher may attempt to 'fit' the data to desired frameworks or concepts. Since these disciplinary assumptions often drive the initial identification of categories and codes, they unavoidably influence all subsequent analysis by reinforcing biases and assumptions within the literature from which the categories and codes were derived. Ensuring that emergent "categories are 'grounded', rooted empirically in the data and conceptually in the research issues" (Arksey & Knight, 1999, p. 164) becomes an ethical concern for the researcher. I attempt to address these concerns of personal and intellectual bias through transparency of methods, the use of 'thick descriptions', and reflexivity.

Denzin (2001, p. 99) refers to thick descriptions as "descriptions [that] capture and record the voices of lived experiences," which can then be included in the research write-up as a way to truthfully represent the experiences of stakeholders in the planning process and the types of knowledge that they are using. Reflexivity is described as an:

> [emphasis on] an introspective stance toward one's own reception and conception of information, and thus intends to provoke an awareness of how a researcher's positionality as well as his or her own practices can influence the construction of knowledge regarding a place or process. (Glass, 2014, p. 70)

Reflexivity in research can reduce the influence of "preconceptions and assumptions…that inform" the inquiry of researchers (Charmaz, 2003, p. 319). For this research, I aimed to practice reflexivity throughout my interactions with interview participants and committee members, as well as at all stages of coding and data analysis.

I recognize that my participation in the planning process influenced my research topic: experiencing the conduct of committee members, listening to discussions, and recognizing patterns of (non)communication led me to the perception that certain types of knowledge were being privileged over others. The underlying rationale of my research thus became an effort at

legitimizing ‘other’ voices at the table in an effort to ‘raise up’ alternative knowledge types. To clarify, the research does not aim to neutralize, mute, or suppress some knowledge types in favour of others, but to ensure that the planning process provides committee members with an opportunity to address and integrate the diverse knowledge types of participants in an equitable manner.

2.6.1 Coding

During the interviews participants made numerous mentions of knowledge within the committee, both implicit and explicit. I coded explicit comments as ‘Declarations of knowledge’, with a distinction between a self-declaration of a participant’s own knowledge and the declaration of another committee member’s knowledge (Table 3.1). The distinction is important to make when considering the value placed, either by themselves or by others, on a committee member’s input and their participation in the planning process.

I assigned an initial label for the knowledge types identified in the planning process; this applies primarily to Objective #1, but has implications for the other objectives as well. As previously mentioned, the literature review was used to develop an initial set of knowledge types, which was modified through multiple iterations of: reading of the transcripts, review of the identified references, and review of the descriptive codes (codes that describe an aspect of the phenomenon), coded text, and classification scheme. The knowledge types I identified in the transcripts are explained in the results section (3.1). In addition to identifying declarations of knowledge, I coded the transcripts to identify passages that describe two characteristics of knowledge: determinants, or sources; and importance, or role. This directly supports Objectives #1 and #2, which aim to identify knowledge types present and determine the extent to which those knowledge type have an effect upon the watershed planning process.

The ‘Determinants’ of a specific knowledge type reflect the foundations of that knowledge type according to participants. Determinants often refer to the source of a specific knowledge, e.g. local knowledge is acquired through long-term experience in a place, or scientific knowledge through formal education. This approach is similar to how Taylor & Loë’s (2012) use of participatory evaluation led to a description of spatial extent as a determinant of local knowledge. The ‘Importance’ of a knowledge type reflects its perceived role in the success

of the planning process, as stated by the interviewee. The suggested importance of a specific person within the planning process can also represent the importance of a knowledge type if it has been attributed to or self-declared by a committee member.

2.6.2 Synthesis

Through a synthesis of the first two objectives, I fulfilled the final objective: to explain how different knowledge types become privileged in the watershed planning process. This involved clarifying the role of power and positionality of knowledge types in watershed planning within Canada, using evidence from the Pike Lake watershed planning initiative. Lessons from this research are applicable to the body of knowledge on planning, especially that of watershed planning. In terms of knowledge mobilization, I presented an overview of the planning process at a conference co-hosted by the Partners FOR the Saskatchewan River Basin and the Canadian Water Resources Association in October 2014; I am also pursuing a journal publication to ensure that the lessons learned are incorporated into the existing knowledge base on watershed planning in Canada. A final outcome of the research is to provide feedback on the planning model used by the Pike Lake committee. Such feedback is important to ensure that their recurring planning process effectively and equitably integrates the full range of stakeholder knowledge types represented on the committee. To cite Smit et al. (2015) at length:

> Rigid and mechanistic 'one-size-fits-all' processes are not appropriate, but neither is simply assuming that the participants in collaborative processes will have the skills and experiences needed to respectfully use distinct types of knowledge. Proponents of collaboration must therefore actively design collaborative processes in ways that foster and support the mobilisation and use of the diverse types of knowledge that their participants will bring to the table. (Smit et al., 2015, p. 441)

I will present my experiences, findings, and recommendations to the Pike Lake planning committee through an oral presentation and a written report.

3 RESULTS

Eleven interviews were conducted over fifteen days, from June 19 to July 3, 2014. Interviews lasted from 22 minutes to 73 minutes, with an average of 42 minutes (see Figure 3.1: Box plot of interview lengths.). All committee members of the Pike Lake Watershed Planning Committee (hereafter the Committee) were interviewed, representing a range of relationships with Pike Lake (see Table 3.1 and Table 3.2). I transcribed all interviews and provided them to participants for review on July 14, 2014. Two transcripts, covering three committee members, were withdrawn over concerns of anonymity.

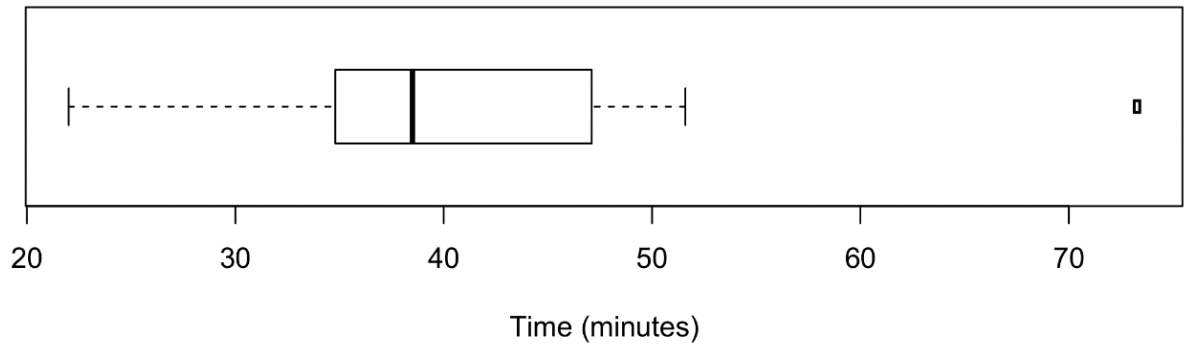


Figure 3.1: Box plot of interview lengths.

In Table 3.1, participants have been labelled by their relationships with the Pike Lake area. Some participants have multiple relationships and bring a specific set of experiences or knowledge pertaining to those relationships; the relationship listed first is the one with which I will refer to those participants. Although knowledge types are shown as categories in the column headers, referring to participants by relationships with a place reflects the argument in the literature that relationships are more appropriate as labels than "academic categories" (Raymond et al., 2010).

Beyond obvious relationships, such as scientific knowledge attributed to the Watershed engineer, there is potential for overlap in knowledge types and relationships. For example, an elected official from a local Rural Municipality (RM) is a farmer, has been involved in the RM council for approximately fifteen years, leases a lot in the Park, and grew up in the Pike Lake area. Thus, the RM official's knowledge is a blend of the experiences from all of those relationships; furthermore, his academic training complements his knowledge as a 'way of knowing' or

a lens to interpret his long-term observations of hydrological and climatological conditions in the area. This kind of overlap is characteristic of hybrid knowledge (Reid et al., 2011), and is documented in the watershed planning literature (Smit et al., 2015).

Table 3.1: Declarations of knowledge types by participant relationship.

	Knowledge types				
Participants by relationships	Bureaucratic	Local	Practical/ Administrative	Scientific	Interview feedback?
Park area manager	O	O	SO	S	OK
Park supervisor	O	O	SO		none
Area resident #1	S	S	SO	SO	OK
RM Councillor (Vanscoy), Area resident	S	SO	S	S	none
Lessee #1	S		SO		none
Lessee #2		S	SO	SO	none
RM Reeve (Montrose), Farmer, Lessee	SO	SO	S	S	none
Park resident		S	SO	S	Revised grammar and some content
Watershed engineer	S		S	SO	OK
Non-participants					
Farmer #1	O	O	O	O	Retracted
Farmers #2 and #3		O		O	Retracted
Facilitator			O	O	Not interviewed

Note: S indicates a self-declaration, O indicates a declaration made by another participant.

Table 3.2: Length of time for participant's relationship and profession.

Participant by relationship with the area	*Details*	*Length (years)*	*Other profession/career*	*Length (years)*
Park area manager	Responsible for operations of multiple Provincial Parks (2 years total)	1.5	Park supervisor, maintenance supervisor	28
Park supervisor	Day-to-day managing and operation: project budgeting, seasonal hiring	14		
Area resident #1	Acreage owner on east side of the Lake	11	Biologist with an environmental non-government organization	20
RM Councillor (Vanscoy), Area resident	Representation of area residents, management of RM affairs; Life-long resident	7	Retired; worked at a chemical plant prior	34.5
	Homesteading heritage	>100		
Lessee #1	Cottage owner, west bank	4	Retired; production manager at a Saskatoon newspaper prior	10
	Board member, Pike Lake Cottage and Watershed Association (PLCWA)	~2		
	Member, Provincial Parks Cabin Owners' Association	n/a		
Lessee #2	Cottage owner, east bank	14	Biology teacher	4
	Member, PLCWA	n/a	Educational consulting	5
			Special project with aboriginal peoples through 4H	20
			Executive director of a Saskatoon educational non-profit	12
RM Reeve (Montrose), Farmer, Lessee	Head of RM Council (less than a year); Member of Council ("on-and-off")	15	High school teacher (science, physical education)	20 (15)
	Lessee on west bank of Lake	30		
	Farming of land "right next to the Park" to the south	>15		
	Member, PLCWA	n/a		
Park resident	Cottage owner, west bank (resident)	12 (7.5)	School administrator prior to retirement	>15
	Board member, PLCWA	n/a	School teacher prior to admin-istration	n/a

Participant by relationship with the area	*Details*	*Length (years)*	*Other profession/career*	*Length (years)*
Watershed engineer	Operation of water works, stakeholder engagement, regulatory enforcement	8	Construction consulting, including surveying and inspecting	2
			Watershed engineer with WSA	9
Non-participants				
Farmer #1	Lives and farms land to the north of the Lake	>20	Crew foreman at a mine	n/a
	Life-long resident	>50		
Farmer #2	Lives to the east of the Lake, farms to the south and east of the Lake	>20	Dispatcher	n/a
	Life-long resident	>50		
	Homesteading heritage	>100		
Farmer #3	Lives to the east of the Lake, farms to the south and east of the Lake	>20		
	Life-long resident	>50		
	Homesteading heritage	>100		

Note: n/a/ indicates that the information was not in the transcripts

3.1 Knowledge Types

3.1.1 Bureaucratic

Bureaucratic knowledge can be described as the "[s]pecialised knowledge of the functioning of government" such that "knowledge of political systems and function [allows] the group members to more effectively influence government bodies involved in water governance" (Smit et al., 2015, p. 434). Determinants include activity or type of experience, with expertise related to length of experience. Types of activities or experience include the position as a government representative or agency employee, or interactions with government representatives and agencies through work. The length of experience is used as a qualifier for bureaucratic knowledge as an indicator of power, which is evident when reference is made to a committee member's ability to influence. Three aspects or dimensions of bureaucratic knowledge were evident: knowledge of people in positions of power, knowledge of how to navigate bureaucratic structures, and knowledge of rules and regulations; a fourth, complementary aspect pertains to learning through communication.

3.1.2 Networks of power

Again referring to an elected official as an example, he has been involved in local government for approximately 15 years, and also claims to have attended 'many' meetings nationally, provincially, and locally; he has also self-attributed leadership qualities. In this case, the official's bureaucratic knowledge was generated not only by his experience with bureaucracies, but also through extensive networking through social interaction at various scales of activity:

> I think [the elected official] has the influence, both politically at the provincial level [and] locally … to be of *real* assistance to us. ... It's a matter of making sure he's committed to us [so] that we can use that influence. (Park resident)

These "built relationships" are seen as fundamental by the Park resident. He reports on how the PLCWA pressed various contacts—known to the Park resident through his extensive engagement in watershed management committees—to push for action from the WSA on infrastructure issues, and to undertake an investigation into raising the lake level. Through networking, he "knew *who* to contact…[and] could contact them with a sense of confidence that they'd at least listen."

External networks, as a form of bureaucratic knowledge, are not the only relationships necessary for the success of the planning process. In terms of power, one elected official feels that "if you're talking a larger area, I think you have to have the municipal support automatically. If you don't have that, things will go nowhere." This sentiment was repeated by other participants, with one reference suggesting that municipal participation and support is a directive from the "provincial government" as opposed to a decision based on the committee's desire to be inclusive.

3.1.3 Tacitly navigating bureaucracy

Bureaucratic knowledge can also be accumulated private sector work that directly interfaces with government agencies, and also through membership in community or business associations. In his 10 years as a production manager at a Saskatoon-based newspaper, Lessee #1 claims to be "used to dealing with government" and "quite comfortable…when talking with decision-makers." This 'comfort' can be seen as tacit knowledge of how to navigate bureaucracy, knowledge that can potentially be exercised to influence government agency representatives. Lessee #1 is also an active member in the Provincial Cabin Owner's Association, an organization

that seeks to bridge the "*real* disconnect between [Provincial Park] lessees [and the] department."

Area resident #1 also expresses a tacit form of bureaucratic knowledge when describing his current work, which involves "a lot of…working with government and industry…so that they can make better land use decisions." Whereas one elected official used bureaucratic knowledge in conjunction with his position to leverage change, the Area resident is using bureaucratic knowledge, along with other types of knowledge, as a means of influencing government agencies, private industry, and land owners to make conservation-oriented resource management decisions.

3.1.4 Explicit rules and regulations

Another aspect of bureaucratic knowledge pertains to knowledge of the rules and regulations that generally govern water-based stakeholder activities. The Watershed engineer has developed this type of bureaucratic knowledge through responsibilities at his work at the WSA involving "regulatory processes and ultimately [our] act and legislation…ensuring that people have the proper approvals in place, their water rights and so on, as well as drainage complaints." While similar to navigating bureaucracies in that it deals with political power, this aspect of bureaucratic knowledge relates to an explicit type of knowledge since the rules and regulations are codified.

Other examples of this knowledge arise with questions of authority, regulatory power, and responsibilities at the provincial and local government levels. Concerns at the local government level include the constraints on the authority of RM's, with the Park resident referring to the value of learning about "what the municipality can and can't do, what the authority they have and don't have" from committee members with that knowledge.

Bureaucratic knowledge of rules and regulations was also cited as a way for Park management to avoid taking action on certain issues:

> They'd just say 'oh, well, the lake's not our responsibility'. Well on paper, maybe it isn't, y'know, they don't have the legal authority over certain things, but that whole park *exists* because of that lake…They've gotta understand—and not just [at the Park area manager's] level, but, you know (hand gesture for higher level). (Park resident)

3.1.5 Learning through communication

The inclusion of government representatives and employees is considered vital for the success of the plan in general. Interview responses tended toward this inclusion as an issue of representation and power more so than knowledge, yet the importance of having members 'in the know' regarding rules, regulations, and people is still acknowledged. This complementary aspect of bureaucratic knowledge is predicated on the presence of sufficient practical experience or administrative knowledge to facilitate communication, and thus enable learning to take place. According to the Park resident, the sharing of bureaucratic knowledge helps to avoid situations where "people like us just assume the wrong things" about authority and responsibility. Communication also helps relay information about how Provincial agencies operate, expanding the bureaucratic knowledge base amongst committee members. As the Area resident #1 attests, it can "sometimes be hard to get an idea what any bureaucracy is going to do, right, if you're outside of that… just by the nature of the beast." Communication is meant to be two-way, and there were comments about how the planning process provides an opportunity to "speak and challenge the people in power, like our government people" (Elected official). Two-way communication was also mentioned in terms of stakeholder engagement, especially for the WSA to "find out…what water levels or *range* of levels…do the public *want*, and do they *need*." As the official comments, it is important to communicate with Provincial agencies, posing the question "until they hear it, will anything change?"

While open channels of communication might help stakeholders understand the bureaucratic decision-making process of Provincial agencies, there are still issues of personality and authority to contend with:

> really up until [the Park area manager] came to the park, we really had *no* communications with anybody other than [the Park supervisor], and he was virtually hamstrung by the [previous] area manager…He was a micro-manager who wouldn't let [the Park supervisor] make a decision on his own, or do *anything* on his own, essentially. [And] frequently if [the Park supervisor] made some kind of a decision, he would countermand it. (Lessee #1)

Following a change in Park agency personnel, the relationships between stakeholders and the Park began to change in a positive manner, with greater levels of communication leading to trust and cooperation.

3.1.6 Local

Local knowledge is characterized by Raymond et al. (2010, p. 1768) as "[k]nowledge that reflects understanding of local phenomena" that is generated through personal experience. It is often associated with "some level of expertise of a local site or issue," and assumes that knowledge generation "lacks structured processes that regulate the way…experiences affect understanding." Ashwood et al. (2014, p. 432) argue that local knowledge has "[become] synonymous with place-based knowledge that incorporates the variability of the landscape, often in opposition to expert, top-down imperialism that treats all geographic spaces as the same."

Local knowledge was both self-declared and attributed to committee members. Attribution was typically based on the recipient's activity within the area (e.g., Park supervisor or manager, farmer), on the committee member's relationship with the area (long-term resident, lessee), or some combination of the two. Participants focused on three general criteria for local knowledge: spatial boundaries, the amount of time spent in the area, and the implications of local knowledge as an informal 'way of knowing'.

3.1.7 Spatially bounded or confined

References to local knowledge were often couched in terms of the "concerns" of farmers, or "impacts" on farm or Park land. This reaffirms the experiential roots of local knowledge while also constraining the perceived empirical validity of expressions of local knowledge. For example, the Park resident stated that "we need to go on that tour [of the farm land], so everyone understands what they're saying and what their land arrangement's like back there, we don't even know," suggesting that this knowledge is still implicit, as the farmers have not yet "articulated [it] in a form accessible to others" (Raymond et al., 2010, p. 1768)(Raymond et al., 2010, p. 1768).

Participants suggested that the generation of local knowledge is based on a committee member's spatially bounded activities in the area. Examples commonly referred to farmers:

> [The farmers] seem knowledgeable of their *own* land. (Lessee #2, emphasis original)
>
> The guys that are on there from the farm group are really knowledgeable about their farming operations and stuff there, all three of them. (Elected official)
>
> The guys that-the farming community, people that have lived there all their lives, and they know what six inches above FSL [Full Supply Level] will do to *their* land. (Park employee, emphasis original)

Lessee #2 considers these spatial boundaries to be significant, and comments on the variation of local knowledge and 'ways of knowing' within the area: "some people in the Park have different knowledge and ideas toward knowledge than a farmer a few hundred metres away." Differentiation of local knowledge by geographic location can be partly explained by the specific sets of 'impacts' or 'concerns' voiced by committee members or stakeholders. Whether erosion on the east bank, springs emptying aquifers on the west side, or standing water within the Park or in farm land, stakeholders experience different physical expressions of interrelated environmental phenomena.

Although commonly associated with the farmers, local knowledge is also attributed to Parks management and area residents. The importance of having a representative from Parks management on the committee is repeatedly mentioned when discussing stakeholder inclusion, indicated the perceived value of their knowledge. Their experiences in the day-to-day operation of the Park means that "they know a lot about that park," much of which "we don't know, so it needs to come [to the meetings]" (Elected official).

3.1.8 Time in, and relationship with, place

Participant responses suggest that there is a link between a person's relationship with a place and the time spent in that place. The time aspect of local knowledge generation is highly nuanced, non-linear, and is qualified by the type of activities undertaken within the area. The non-linearity of local knowledge is attributed to the 'fuzziness' of memory and informal nature of oral history; local knowledge that is not formalized or explicit is seen as subject to degradation.

3.1.8.1.1 As a farmer

Three of the farmers have been farming actively in the area for most of their lives (30 years or more), while one elected official has been farming for a comparatively shorter period of time (since "the 90's"). In most participant responses, the "farm group" does not include the official, but his farming knowledge is neither discounted nor dismissed. References linking local knowledge and farming included comments on farming ability or skill, which were coupled with a qualifier of length of residence. Other references include a spatial component, as described above, and affirmed by the Watershed engineer: "the farmers around the area, they've been there a long time and they've seen a lot over the years." This lifetime of experience provides the

"background knowledge of…how the lake [has] performed over many, many years," which is an important "base of experience and knowledge" to have in the committee (Park area manager).

High water levels have recently become a major concern for "certain farmers in the area [who] are concerned about the height of the lake because their soil is so saturated…They can't seed it, I mean, that's reality" (Elected official). Whether draining water from southern and eastern farm land "where it, to me, where it should be going, into Pike Lake" (Elected official), or removing beaver dams and clearing channels to drain the Lake and lower the water table in northern farm land, existing management actions reflect the mental hydrological models developed over time by farmers as well as long-term area residents, the WSA, and Parks management. For some, these models are informed by scientific knowledge whereas others are informed by long term, fine grained observations. A Provincial Parks employee and elected official agree that the PLCWA's request to investigate the possibility of raising the FSL is an undesirable proposition, especially with respect to the likelihood of flooding low-lying farm land and areas within the Park, as well as the possibility of negatively impacting infrastructure paid for solely by rate payers within the RMs.

Resistance to raising the FSL of the lake reflects the recent impacts of persistently high water levels experienced by stakeholders; the WSA has not had to pump water into the Lake since 2009. Other participants have differing mental models of how water moves through the area, as evident in the statement by Lessee #2 that there are "some pretty different ideas about where that water came from, and…how high it's gonna get." The farmers have been managing their lands for decades, and are considered experts within their specific operations, yet their mental hydrological models are not considered as representative of reality since they are not based on scientifically gathered evidence.

3.1.8.1.2 As a resident

Different stakeholders will have different local knowledge based on the types of relationships with the area as well as the length of those relationships. Park residents are described as more focused on the specific issues that impact them, based on: space (e.g. residents on the west side of the lake being concerned about the aquifer, east side about erosion), and time (e.g. full time residents are concerned about "the health of the lake", seasonal users about water levels for their boats). Prior to participating in the planning process, seasonal user Lessee #1 "just wanted

to have more water so that I could use my pontoon boat in more places. Now I'm thinking about watersheds and all this other stuff that had never crossed my mind before".

Time spent seasonally is not the only factor. The Watershed engineer discerns a difference in the nature of the local knowledge contributions by cabin owners and residents who are "newer to the lake" than farmers and other long-term residents. There are two general local knowledge areas or sub-types that are expressed in the interviews: Local Social Knowledge (LSK), and Local Ecological Knowledge (LEK).

Local social knowledge, or "history". Local social knowledge includes personal experience growing up and living in an area, and assumes some level of social interaction has taken place during that time. It implies an involvement in a local 'community', knowledge of a way of life and other people in the area, and a recollection of prior activities and changes in the area, including infrastructure. For some committee members, a family history of homesteading in the area enhances the perception of their LSK and local knowledge generally.

Local ecological knowledge. Local ecological knowledge includes references to general experiences in the local environment (climate, hydrology, ecology), as well as assessments of risk in terms of ecological health. One elected official recounts that he was asked "questions about the environment and…what my perception is of what they're doing and that kind of thing." He also comments on Pike Lake's ecology, quoted at length, as it relates to the potential goals of the planning process:

> they asked me what I thought about preserving the ecology, and I answered them with a question, which was "which ecology do you want to preserve?" And they didn't quite know what I was asking, "what do you mean by that" type of thing, and I told them, "Well, there was an ecology when my dad was a kid here in 1906." I said, "there was an ecology 50 years ago when I was a kid, and there's today's ecology. They are not even close to-any one of them is not even close to the other, so which one do you want to preserve? Do you want to put the lake back to where it was originally? Or do you want-do you want to work toward that or do you want to preserve what there was 50 years ago, or do you want to preserve what you've got today?" which is basically a slough as far as I'm concerned. But, when my dad was a kid, the lake was a white sand bottom, and you could see the bottom at 20 feet. Humans have changed the lake, it didn't happen by nature. (Elected official)

While the substance of the elected official's comments reflect the long-term accumulation of LEK and local knowledge, it is important to note the disagreement between his assessment of the Lake as being 20 feet deep and the Watershed engineer's statement of the lake being 10 feet

deep. Sediment deposition, biomass accumulation, differing perceptions, and rhetoric may all play a role in the discrepancy.

3.1.8.1.3 Through employment

The relationships of the Watershed engineer and Parks representatives with the Lake are based on their employment. This leads to the generation of local knowledge that is unique to their work-based responsibilities, and is seen by the Park supervisor as substantively different from local knowledge held by residents. For the Watershed engineer, his work consists of activities that can generate and are based on scientific knowledge, including operations such as "pumping [into the lake], releases [from the lake], keeping track of the water levels that we read off the staff gauge and so on." In addition to operations, the watershed engineer also fields calls from both farmers and the PLCWA. This liaison role leads to "the ongoing communication that we have with a lot of these groups," generating sufficient local knowledge such that "there was nothing really that was brought up at the meetings that I was completely shocked or blown away that a group wanted that or-or was suggesting that." Parks are also seen as a significant contributor of local knowledge due to the fact that "they're there all the time, and have been" (Watershed engineer).

The Watershed engineer also comments on what might be considered as either localized scientific knowledge, or a formalized and explicit local knowledge:

> I think we bring a lot to the table, and I think can bring the-a lot of the history as well, in our-in our files and so on over the years, I mean we have lots of plans and lots of just.. information on our files about the history of Pike Lake, when works were completed, and things of that nature, so just a lot of background and history information. (Watershed engineer)

Instrumental records, surveys, and operational information combined with changes in infrastructure supply a unique type of local knowledge that can be combined with LSK to build a more complete description of the types of changes that have occurred in the area. Greater detail in this regard can provide for a more informed interpretation of local knowledge.

3.1.9 Ways of knowing

Following on Lessee #2's comment of differing "ideas…toward knowledge" within the local area, other participants also commented on differing epistemology. Lessee #1 suggests that "some of the people [that] have been around there all their lives…tend to think anecdotally rather

than scientifically." The Watershed engineer expressed similar concerns about the validity of local knowledge, but focused on the fallibility of memory rather than the informal nature of local knowledge. He notes that knowledge expressed by long-term residents may be given more weight than it deserves, as other participants may feel that "they've been there forever so what they're saying is true." The significant overlap between local knowledge, scientific knowledge, and 'ways of knowing' is addressed more thoroughly in the Scientific Knowledge section below.

3.1.10 Learning through communication

This aspect of local knowledge, as with the communication aspect of bureaucratic knowledge, is predicated on the presence of sufficient practical experience or administrative knowledge to facilitate communication, thus enabling learning to take place. While historical local knowledge is seen as important to understand environmental and social change in the area, contemporary local knowledge is also considered relevant, especially when discussing "the concerns of the local farmers." Generally, these concerns relate to existing water management actions, including "beaver control ... [and] brush clearing to get the outlet moving water more effectively" (Area resident #1). As mentioned previously (subsection 3.1.8), these actions are intended to reduce water logging of farm land that has not historically been impacted by soil saturation. According to the Park resident, these types of discussions "really opened people's eyes a bit to each other's needs and wants and concerns," providing a foundation for more effective engagement and integration of local knowledge. Further attestation comes from Lessee #1, who feels that these conversations within the planning process have "given everybody a little more understanding on what everybody else worries about." The planning process has also given the Watershed engineer an opportunity to explain the reasons why the lake level "can't be just sitting parked at that 481.94 [elevation at FSL] and never move a centimetre above or below that. …from evaporation to-to water use…and obviously all the issues around the pump site as to why it can't be parked at that elevation."

Statements of learning typically focus on the sharing of "concerns", "impacts", and "interests" held by local stakeholders, which are related to their spatially bounded experiences of phenomena through time. This sharing is seen as a way to build trust, understanding, and respect, and has resulted in changes in the way the stakeholders interact: "there was also yelling at first

meeting we had the Water Security Agency up…that's changed too, that doesn't happen anymore…I think we're growing, socially" (Park resident). Similar observations were noted by other participants.

3.1.11 Practical experience/administrative

Practical experience refers to a type of knowledge that is accrued through a range of personal experiences, usually in a professional role. It is often a blend of either tacit and expert, or tacit and lay knowledge types as defined by Raymond et al. (2010). Lay knowledge is "some form of non-expert, localised or informal knowledge reflecting people's everyday interpretation of a situation, in contrast to expert knowledge or knowledge derived using a formalised process" (Raymond et al., 2010, p. 1768). For this research, it can be understood as non-scientific knowledge that is considered to be indirectly applicable to the planning process. Lay knowledge was not attributed to any committee members, only self-declared, suggesting that participants were either optimistic or reserved in their assessments of what others could contribute.

Broadly, *administrative knowledge* is a tacit form of knowledge that allows for the recognition of expertise. Participation on committees or boards that follow standardized procedures for their functioning (e.g. the adoption of Robert's Rules of Order) can generate administrative knowledge. More narrowly, administrative knowledge also refers to experience with the logistics of organizing and administering meetings; examples include delegating or undertaking tasks such as minute-taking, agenda writing, room bookings, finances, or the chairing of the meeting. Borrowing from the concept of Procedural Knowledge (Schneider, Rittle-Johnson, & Star, 2011, p. 1525), which is "the ability to execute action sequences to solve problems," both the broad and narrow aspects of administrative knowledge involve some level of "action sequences" to achieve an end goal. They also require some flexibility in their adaptation from context-specific applications (i.e. administrative knowledge from a career in educational administration can be applied to organizational-level actions in watershed planning). As a formal type of knowledge, administrative knowledge is "used in all forms of resource management and formally organized decision making in governmental and non-governmental organizations (with components of scientific, normative and practical knowledge)" (Stepanova, 2013, p. 13, Figure 3). Administrative knowledge can be construed as an expression of expertise stemming from extensive practical experience in a specific field.

Amongst the participants, this type of knowledge came from experiences in various administrative positions as well as prior involvement with committees or boards that follow standardized procedures. Administrative knowledge is also blended with bureaucratic knowledge and local knowledge in some instances, such as when administrative knowledge is accrued through a position as a local government representative. Three aspects of practical experience or administrative knowledge are evident in the interviews: Practicality as a way of knowing; experience on committees, including in watershed management; and administrative or managerial experience, including leadership and practical skills.

3.1.12 As a way of knowing

The wording of references to practical experience include "solving problems", "practical thinking", "common sense", or "making decisions". Both an elected official and Lessee #1 emphasized the importance of milestones (as progress or achievement), maintaining a pointed focus for the process, and practical problem analysis. For those with practical experience in managerial roles, aspects of the planning process that emphasize deliberation, consensus building, and broad stakeholder inclusion prove to be frustrating:

> I thought we had *way* too broad a list [of stakeholder concerns]. And then once it got narrowed down, I was much happier with it. (Lessee #1)
>
> you've done a lot of the…sort of incorporating everybody, but now we have got to get down and get it-(tapping table)-get it *done*. (Elected official)
>
> I think he was trying to be reasonable [in the risk assessment], but he was just very quick to (finger snap), rather than suggesting "well what do you think, people, about a, you know…". Anyway, a *softer* response is…and that's [the Park area manager], you know. You're…asking him and he was giving answers (laughter). (Lessee #2)

While there are distinct groupings of sources of practical experience in the transcripts, there does not seem to be a relationship between those groupings and the difference that exists between the practical 'way of knowing' and the contrasted "educational approach" identified by the Park resident.

3.1.13 Committee experience

Six of the participants claimed to have had prior experience with committee meetings aside from watershed planning and management. A sample of these experiences include: active membership in or board positions with local and provincial associations; board positions with regional, provincial or national committees; and participation in volunteer groups. This type of

knowledge or experience can be an important precursor to deliberation, as it can determine the level of comfort a committee member has with participating in the meetings and in the process. For example, the Park resident, with extensive watershed committee and procedural experience, justified his restraint in discussing a topic at a meeting, stating that "the evolution of the process will give me the chance to say whatever I want to say." According to an elected official, such confidence in the process is not evident in some of the farmers who have not been involved in a similar planning process:

> The guys who are farmers, and myself as [an elected official], we're kind of sitting there, we're in the position where we feel we have to be there, because if we're not there, we don't have nothing to say about it. And being there, even when you're not sure what you're doing there, is better than having someone make the decisions 'cause there is no representation to help them make that-or to maybe have a dampening effect on their-on their decisions. (Elected official)

The farmers' lack of committee experience, and the elected official's lack of experience in watershed planning, leads these participants to take up a reactionary or defensive position, which can have a negative impact on their participation.

3.1.13.1.1 Watershed management

Participant experience with watershed management processes varied. Four participants had never been on a watershed planning or management committee prior to their participation in the Pike Lake planning process. The Park area manager's experience on two water management committees in other regions of the province "seemed to help me when it came to this Pike Lake [process]." The other four interviewees have participated on numerous watershed committees in different capacities, either as a non-governmental watershed organization manager, as technical or advisory committee members, or as a liaison to watershed organizations. With respect to organizing the planning process, Area resident #1 thinks that "[committee members having] a familiarity…with watershed planning" has been very helpful.

The facilitator's previous experience in watershed planning processes was considered important in making the process more expedient, "[He] helped move things along more quickly, I think" (Area resident #1); less imposing, "[We] really broke down the planning process, which I liked. 'Cause sometimes you get bogged down, it just looks too overwhelming" (Park area manager); and more accessible, "[He] kind of laid it out pretty well for us, what [needs] to be done and, y'know, the steps that [we] have to go [through]" (Park supervisor). Having an experienced

facilitator not only aided in making the process more accessible to those without previous experience, but also made it more enjoyable for those who have had to sit through meetings that "really go down rabbit holes … [with] meeting after meeting after meeting and you're not accomplishing much" (Area resident #1).

For Area resident #1, his experience in stakeholder engagement and outreach involves negotiating with government agencies, industry, and private landowners, which has given him the "the opportunity to see the different…angles or opinions that different sectors are working from." The result is a practical understanding of watershed management, with a view that "you don't want to regulate everything to get a positive change, it can be done through…just common sense." His experience is not just with stakeholder engagement, as his academic training and career with an environmental non-government organization has resulted in his sitting "on a number of these [planning processes]…on the advisory committees or technical committees" (Park resident).

3.1.13.1.2 Lay knowledge as lack of knowledge

Lay knowledge was broadly characterized in contrast to other types of knowledge, with participants claiming that they do not: "bring the knowledge that you guys bring"; "know all that much about watershed groups like this one"; "have *any* real other experience" with watershed planning; or have any "formal education…in that kind of stuff." This characterization of lay knowledge as a lack of knowledge is taken one step further by one of the elected officials, who self-evaluates his knowledge as "useless", although his prior interactions with other committee members leaves him feeling that other members "see more value in my knowledge than I really do, but that's probably because they understand the process…better than I do." There is some uncertainty in this context, however, as the elected official may be referring to the value placed in his local knowledge of the area, as opposed to his general lay knowledge. Raymond et al. (2010) describe a lay knowledge that can be place-based, which suggests that the official is discussing the perceived expert nature of his local knowledge rather than lay knowledge generally.

3.1.14 Experience in an administrative or managerial role

Managerial experience is seen as either resulting in or requiring inter-personal skills such as "basic human relations skills" (Lessee #2, self-reference), "knowledge of people and how they

interact with one another" (Lessee #2, speaking of Lessee #1), or "[experience] in public processes" (Park resident, speaking of Lessee #2). Participant experience in administration or management varied, although it is likely that some participants have had some level of exposure to basic management concerns. Even though not all of the Farmers have formal experience in a managerial role, their on-farm operating experience is, by definition, based on business and land management. Both the Park resident and Lessee #2 had careers that involved educational administration, while Lessee #1 was a production manager (for more information, refer to Table 3.2). Aside from the human relations skills required of a managerial role, which includes leadership qualities, there is no other mention in the participant responses of a relationship between managerial experience and the planning process. However, that aspect of leadership plays an integral role and is further explored below.

3.1.14.1.1 Leadership

One participant was attributed with, and self-declared, a significant level of administrative knowledge as a result of his experience as a school administrator. The importance of having someone with administrative knowledge, in conjunction with experience in leadership positions, is commented on frequently by committee members, especially in terms of the success of the planning process:

> [If] it wasn't for [the Park resident], I don't think any of this would be happening. (Lessee #2)
>
> with [the Park resident's] background and his, I guess, kind of *passion* for what he's doing, I think he's kind of been pushing this whole thing along…which has really been needed. If, I don't think if there was that leadership from him that a lot of this [would] have taken place. (Watershed engineer)
>
> I gotta give credit to [the Park resident] for really organizing that, and getting it set up, getting the key players to the table. (Park area manager)

The Park resident sees his leadership role in the current planning process as "really just an extension of what I've always done in my career," joking that he is "not quite yet finished with meetings." His career in school administration meant that he has experience in "dealing with different personality types and probably some pretty strong ones" (Area resident #1), which is important when attempting to encourage participation and facilitate collaboration between groups with often divergent interests and concerns.

In response to the interview questions, participants assessed the Park resident's abilities as a leader positively, commenting that his "diplomatic" approach ensures that "everybody…gets a chance to speak" (Area resident #1). One danger in having a strong leader is the potential for the process to become autocratic, which would be counter to the inclusive goals of a community-based initiative. In response to this concern, Lessee #2 comments that "most of us would say, 'k we're gonna do this, a-b-c,' and [the Park resident] will say that only after he has made six or eight calls to people (laugh) to legitimize that knowledge." While a strong leader is often vital to achieve critical mass and maintain momentum in a planning process, the ideology of the leader also plays a vital role to ensure that the process remains democratic and community-based at its core.

3.1.14.1.2 Practical skills

Linked to practical experience in an administrative or managerial role is also the development of skills-based knowledge, such as "how to use a computer" or "newsletter creation" (Lessee #2). These skills play a role in the communications between the committee members and between the various communities within the Pike Lake area. Assembling communiques requires not only skill in terms of setting the layout and creating the content, but also extended blocks of time.

3.1.15 Influence on the planning process

The importance of administrative knowledge and practical experience for the planning process can be seen in the preceding subsections. A core group from the PLCWA has been contributing "a lot more time and effort" to the process than other members, which is important for "keepin' the ball rolling" (Area resident #1). This core group includes participants with extensive administrative knowledge and experience in administration and management. The result is seen in comments on inclusion and participation in the process, some of which were mentioned in the subsection on leadership above, in references to group decision-making, and also in the way that some practical experience becomes a 'way of knowing' through which the activities in the process, and the process itself, are viewed.

3.1.16 Scientific

Scientific knowledge is an outcome of formalized processes, and is "[passed] through a strict and universally accepted set of rules qualifying it for a particular use" (Raymond et al.,

2010, p. 1768). Participant references to scientific knowledge were in three dominant aspects: as a way of knowing, as evidence or facts, and as expressions of ecological theory. Agricultural knowledge, a knowledge sub type that blends scientific knowledge with local knowledge, was also present, but participants refrained from acknowledging that the local knowledge of long-term residents was generated in a formalized way such that it would be commensurate with scientific knowledge. I discuss Agricultural knowledge as a 'way of knowing' due to its hybrid status between scientific knowledge and local knowledge. Overall, knowledge of a specific science was considered beneficial to the process, whereas a lack of education in sciences was perceived as a potential barrier, in terms of achieving certain outcomes, for deliberation, and learning.

3.1.17 Ways of knowing

Five committee members declared some level of formal education in 'the sciences', including biology, engineering, and ecology; formal education included training for a teaching role (three participants; one as a biology teacher, one as a "science teacher") and a specialized university degree (two participants). As mentioned, a lack of training can be perceived as a barrier to effective deliberation and learning:

> maybe some of the people around aren't familiar with that kind of information, you could spend a whole bunch of time trying to explain it to them, [and] they'd have to take that back and digest it, and they still might not agree with you in the end. (Area resident [biologist])

Similarly, alternative 'ways of knowing', such as experiential local knowledge, are also seen as a hindrance to deliberation and learning:

> some of the.. old…not myths, but old ideas about [how] water systems and how everything works are ingrained in some of the people [that] have been around there all their lives. They tend to think anecdotally rather than scientifically. ... some of them are kind of stuck in a way, and don't seem to want to listen to any kind of an explanation about why something might be happening. (Lessee #1)

Where a committee member lacks specialized education, or seeks to elevate local knowledge, it is the person that becomes a hindrance, rather than their circumstance or the context of the discussion:

> I'm not sure that, when we do get this report from [the WSA], [that] he's gonna agree to it, or anything. So I think…he might be a stumbling block. (Lessee #1, in reference to an local knowledge holder)

But not all 'alternative' ways of knowing are seen in a negative light. The Park resident is hesitant to declare his contributions as knowledge, stating that he has "a strong emotional and philosophical kinda belief…in an environmental approach, I suppose, or in an ecological base." His "attitudinal…and personal sort of belief system," while informed by formal education, drive his interpretation of phenomena more than his scientific training. This presents an interesting juxtaposition to the supposed incompatibility between the epistemology of scientific knowledge and that of informal, experiential knowledge types.

3.1.17.1.1 Agricultural knowledge

A blend of scientific knowledge and local knowledge was also present as Agricultural knowledge, which I have classified as a sub-type of scientific knowledge due to the phrases and descriptors used in reference to the knowledge held by the farmers and their operations. A number of examples support this classification: from an elected official, "astute", "attention to detail in farming is extreme"; from Lessee #2, "successful farmers ... bright and articulate", "got his agricultural facts pretty straight"; and from the Park resident, "very successful farmers. …they bring rationality and reason to the table, and that's the way they've lived and farm."

3.1.18 Evidence, information, history and facts

Scientific knowledge is considered a resource for historical reference and factual information that can be used as evidence in decision-making. This information is seen as carrying legitimacy, a perception that is carried through to include legitimacy conferred to specific committee members. This legitimacy, referred to in terms of 'power', is considered as a general fact: "[As] much respect as everybody has for [Lessee #2], and they do, it still wouldn't be as powerful as having a University professor who teaches watershed planning" facilitating the initiative (Park resident). While scientific knowledge is legitimate, and can be seen as a type of 'quality control' for local knowledge, it is not immune to the impact of time in terms of invalidation or alteration.

3.1.18.1.1 Legitimacy

Aside from their legislated authority or "control" over the Lake's water levels, the WSA's contributions are held in high regard due to the perceived power and legitimacy of the institutional scientific knowledge held by the WSA. Lessee #2 states that the representatives from WSA provide "legitimate knowledge [and] bring that factual, hard information, which we

all appreciate." The Watershed engineer sees a similar role for the WSA and for himself, in that he can "[provide] maybe sense of reality…to some of the ideas out there" regarding the Lake's hydrological function. The WSA representatives are seen to bring "that scientific background to give us…what we need" (Lessee #1).

The WSA has been developing an engineering report, as mentioned by Lessee #1 above, which is essentially a technical study on the possibility of raising the Full Supply Level (FSL) of the Lake by six inches; it has not yet been released to the public. Generally, the assumption is that, if the report concludes that the Lake and associated infrastructure can support the increase, the WSA will increase the FSL regardless of the impacts and concerns of both farmers and the Park operators. Since the local knowledge-based mental models of local hydrology held by farmers and long-term residents are perceived as "not science-based" (Lessee #2), they are discounted or dismissed outright in favour of the scientific basis of the WSA report.

3.1.18.1.2 Time

Although the Watershed engineer acknowledges the importance of long-term local knowledge in supplementing the instrument-based records of the WSA, he is still wary of local knowledge in some contexts. His concern is that local knowledge may be taken as writ due to the perceived authority stemming from long-term residency, even though the instrument record may prove otherwise. While scientific knowledge is referenced as a foundational necessity, Lessee #2 acknowledges that scientific understanding itself is subject to change when he comments on "the little [science education] that, academically, I was prepared for forty years ago, however much of that is still relevant (laugh)."

3.1.19 Ecological theory

Through references to ecology, scientific knowledge is also used as a narrative device to justify intervention-based management actions. These references include direct or indirect references to theory, such as complexity and uncertainty, carrying capacity and biodiversity, and scale in terms of time and space.

3.1.19.1.1 Complexity and uncertainty

Only a few of the committee members have received formal training that included components of ecological theory. One participant admits that he "[doesn't] know much about…a lot of the ecology and all of those kinds of things" (Lessee #1); similarly, "[the Park supervisor]

didn't go through a resource technology [program] or have an understanding of ecology," although it is acknowledged that such a "frame of thought" is not a requirement for his position (Park resident). While the presence of ecological knowledge is not widespread in the committee, two participants with scientific knowledge commented on the inherent uncertainty in knowledge of ecological function, leading them to accept the limitations of interpretations through an ecological understanding:

> Nature proves us, you know, very narrow in our understanding [of natural phenomena]. (Park resident)
>
> [Speaking in reference to the potentially conflicting water levels possibly desired by different stakeholder groups] Nature has so many ways, through rainfalls like we've had here, changing all that anyway (laugh). Sometimes I wonder if…it really matters. (Lessee #2)

3.1.19.1.2 Carrying capacity and (bio)diversity

A goal repeated throughout the interviews is that of maintaining "a healthy lake, ecologically and recreationally well into the future" (Park resident). This goal is seen as requiring continued vigilance and planning to "make sure that we don't *over*load the ecosystem with too many people" (Elected official, emphasis original). Management of the ecosystem and of the people that affect or are affected by it are seen as going hand-in-hand. Linked to carrying capacity and management of the ecosystem is the concept of biodiversity. The Park resident draws a link between diversity in ecology, and diversity in the planning committee:

> diversity is unity, and that's an old ecological principle. And I suppose there's [sic] times when you wanna curb that diversity, but I think in *most* situations, the more diverse a planning group, the better results you're gonna get. (Park resident)

The transfer of ecological concepts between ecosystems and social systems also occurs in terms of community and scale.

3.1.19.1.3 Scale

Community. In applying the concept of communities to residents and stakeholders in the Pike Lake area, the Park resident comments on social groupings of stakeholders as belonging to distinct communities that are subsets of a larger community. A key consideration in the invocation of community at the social level is the distinction of who is *inside*, and subsequently who is *outside*. Stakeholder concerns about the lake and surrounding area are seen as different both in

kind and by degree depending on a stakeholder's relationship with the area. Park residents are seen as being intimately connected with the "health" of the lake, while recreational users are described as caring only about accessing as much of the lake as possible by boat. Similarly, the concerns of stakeholder groups, or communities, can be interpreted in terms of scale: "My frame of thinking is, 'roads are pretty small peanuts in terms of the big picture of a healthy, ecological and recreational lake'" (Park resident).

Time. Time scale refers to the length of time upon which a participant bases their interpretation of an environmental phenomena. The differing ecological states identified by one elected official (see page 46) reflect the importance of time in any effort to maintain or change the properties of an ecosystem. The elected official argues that "humans have changed the lake, it didn't happen by nature," and suggests that diluting the lake to reduce nutrient build-up and control the growth of undesirable plants is "gonna take you a hundred years, maybe, if you're lucky, to get you back where you were, and maybe more than that." However, the Park resident comments on how he is now able to see the bottom of the lake, attributing the clarification of the water to the greater volume of water that has been flowing through the lake over the last few years. Whether this visibility is a short term indicator of climatic variability or a long-term indicator of human influence and changes in the management of water flow regimes, the difference in time scale used to interpret environmental change leads to conflicting perceptions of those changes.

3.1.20 Influence on the planning process

Scientific knowledge, acting as a "lens" of perception, influences the planning process in many distinct ways. It acts as a way of interpreting phenomena by identifying the causes of environmental change, or through the construction of an ecological narrative that is used to justify a management intervention. Those interventions are either physical, in terms of infrastructure development or operational changes of that infrastructure, or social, in terms of influencing the land-based activities of stakeholders. Ultimately, the logic and rationality of the scientific method is seen as required for the success of the planning initiative.

3.2 Summary

Results from the interviews support the identification of four general knowledge types: bureaucratic, local, practical experience/administrative knowledge, and scientific. Although distinguished as four general types in the results, in reality the knowledge held by participants is hybridized and complex. Each knowledge type is characterized by unique sets of both distinct and shared aspects that describe the role and importance of that knowledge type in the planning process. General themes that emerged included: the importance of learning through communication; the influence of different 'ways of knowing' on learning and communicating; and the diverse and variable impact of time, on the process specifically and knowledge generally.

4 DISCUSSION

This chapter provides an analysis of the results, and links the research to the broader literature. A discussion of the knowledge types identified is followed by a thematic examination of how different knowledge types affect the watershed planning process. Next is a description of how scientific knowledge came to be privileged in the planning process. A summary concludes the chapter.

4.1 Knowledge Types

Although four general types of knowledge were identified in the results section, these classifications are interpretive and debatable (Raymond et al., 2010; Smit et al., 2015). The conceptual framework used in this research to analyze knowledge types is not able to clearly separate knowledge gained through professional work—as experience and expertise—from administrative knowledge. Linkages between experience in a career and the accumulation of knowledge can lead to the conflation of experience with academically defined knowledge types. In general, the results suggest that scientific knowledge held a privileged position during discussions of environmental change and hydrological function of the area. Some stakeholder input on the topic of hydrological function in the watershed was discounted due to the perceived issues of local knowledge validity.

Further knowledge types were also identifiable, but the level of detail in the transcripts did not allow for a thorough account of each. Potential refinements to the conceptual framework centre on spatial considerations of local, but are not confined to local knowledge. For example, local community knowledge could encompass aspects of local ecological and local social knowledge types; the converse might be local regional knowledge, which is a more generalized yet still local knowledge type that can account for intensive local knowledge in small areas within a larger spatial context. Typically, publications that mention these refined types have a narrowed research focus, such as one type of knowledge [e.g. Local rancher knowledge (Knapp & Fernández-Giménez, 2009); agricultural knowledge (Kloppenburg, 1991)], or present a synthesis of the literature to generate a classification scheme (Raymond et al., 2010). The multidimensional scheme put forward by Raymond et al. (2010, p. 1769, Table 1) both refines how

knowledge types are defined or characterized, and exemplifies the 'fuzziness' of knowledge types and categories. Knowledge types were identified in transcripts based on how participants described the knowledge held by committee members, rather than through assignment based on predefined categories. This inductive approach, combined with the establishment of an initial coding scheme, resulted not only in the identification of knowledge types found in other research but also some interesting nuances that are not reflected in the literature.

4.1.1 Bureaucratic knowledge

The bureaucratic knowledge identified in this research aligns with the definition put forward by Smit et al. (2015, p. 434), who recognize it as knowledge "of political systems and function" that can be used "to more effectively influence government bodies." This 'bureaucratic' knowledge is considered to reflect some level of expertise in political matters, which can arise from personal experience in dealing with 'decision-makers' (Raymond et al., 2010). In contrast, Stepanova (2013) would consider the characteristics of bureaucratic knowledge described in the results as attributes of Administrative/managerial knowledge, as well as local knowledge. This overlap is expected, as the administrative knowledge discussed in Stepanova (2013) has a primary focus on the knowledge of decision-makers or public administration.

The 'Networks of power' aspect of bureaucratic knowledge draws from Booher & Innes (2002, p. 225), who describe the concept of network power as "a shared ability of linked agents to alter their environment in ways advantageous to these agents individually and collectively." As was shown in the results, interview participants and committee members are linked both internally and externally, and aim to use those linkages to alter the decision-making environment. According to interview participants, the knowledge of how to navigate those networks, and how to expand it, is a tacit type that one gains on-the-job through "[building] relationships" (Park resident). Frequent interaction with people in positions of power is seen by some participants to be at the core of knowing how to navigate bureaucracy. According the participants, this knowledge, or skill, is refined through experience in a managerial role, either in non-governmental organizations or private industry.

While 'Networks of power' and 'Navigating bureaucracy' are tacit or informal aspects of knowledge, the bureaucratic knowledge described in the results also contains a formal aspect as knowledge of 'Explicit rules and regulations'. This aspect aims to account for bureaucratic

knowledge that refers to codified procedures or laws that construct the institutional and normative boundaries of the management or planning process (Stepanova, 2013). For example, knowing which Provincial bodies or agencies are responsible for the enforcement of the engine size restrictions on Pike Lake is crucial to the development of actions and identification of stakeholders for goals related to that enforcement. Similarly, knowledge of the agreements made between agencies pertaining to lake levels throughout the year are crucial to discussions pertaining to maintaining or altering water management objectives for the area.

4.1.2 Local knowledge

Three aspects of local knowledge were presented in the results, describing how local knowledge is spatially bound, dependent on 'time-in-place', and fundamentally experiential. Participant definitions of local knowledge in Taylor & Loë (2012) included a spatial criterion, although responses were inconsistently phrased and referenced a variety of geographical areas. This criterion applied equally to local knowledge of environmental conditions ("climate, hydrology…and ecology" (p. 1212)), land management practices, as well as people and issues in the community. The "contextual geographical knowledge" identified by Smit et al. (2015, p. 426) also references place-specific events or processes; the authors suggest that local knowledge "is often considered place-based and situated in particular contexts." Similar comments on the geographical scope of knowledge were presented in the results of this research, where participants typically used farm extent as a delineation for environmental conditions and land management practices. These comments reveal an assumption made by participants related to the actual geographical extent of local knowledge held by any of the committee members, a critical concern over the validity of local knowledge also identified in Taylor & Loë (2012). However, Knapp & Fernández-Giménez (2009) suggest that heterogeneity of knowledge is to be expected, as local knowledge is influenced by differences in landscape as well as management objectives. Ashwood et al. (2014, p. 432) also express an expectation of diversity, noting that "local knowledge is richly complex, with various actors possessing different types of situated knowledge." The local knowledge held by farmers is generated through what Bartel (2013, p. 893) describes as "practice-in-place," which is a "co-generative product of particular geographical as well as social features." The author describes *vernacular knowledge* as a knowledge type that is akin to local knowledge but without the spatial restriction of 'local'; it is the result of "biophysical and cultural heterogeneity" such that "each body of vernacular knowledge will be somewhat unique"

(Bartel, 2013, p. 893). In other words, differences in local knowledge are not just to be expected, but are beneficial to the process. The reference to situated knowledge by Ashwood et al. (2014) highlights the context-dependent, power-laden, incomplete or partial nature of knowledge held by individuals (Haraway, 1988).

Time is a criterion of local knowledge acknowledged in the literature, with length of time in a specific area used as a predictor of the level of expertise of local knowledge. Time is also linked to the relationship an individual has with an area, and subsequently the types of activities they engage in. Taylor & de Loë (2012, p. 1212) found that participants "associated local knowledge with long-term and on-going experience in a particular area." For Raymond et al. (2010, p. 1768), local knowledge is differentiated from TEK in that local knowledge develops from experience in an area for "a few generations" or less. Smit et al.'s (2015) "contextual geographical knowledge" is also linked to time through reference to the historical knowledge of an area, which reflects knowledge of the physical environment as well as social history. Conversely, time is also used to invalidate local knowledge through reference to inconsistencies of fading memories and the derogation of oral history as merely "anecdotal." Both time, as a predictor of expertise, and space, as a criterion for "local", are factors in defining a participant's relationship with the Pike Lake area.

When discussing experiential local knowledge, these relationships can be thought of as different types of 'human-environment interactions' (Raymond et al., 2010). For example, farmers are considered to be land managers, and through their constant interactions with the land, develop an intimate, even expert, knowledge of their local environments (Knapp & Fernández-Giménez, 2009). This type of relationship was identified by interview participants, who felt that the local farmers were attuned to their own lands, or "knowledgeable about their farming operations" (Elected official). Distinctions were also made between types of relationships, not just length of time. The variation of local knowledge between day users, seasonal cottage owners, park residents, area residents, farmers, and Provincial representatives is recognized by interview participants, and reflects the significant differences in the types of activities they engage in, the extent of their experiences in the community, and length of the relationship. These different relationships with the Pike Lake area lead to the construction of "Representations of place–which act as containers for group identities and interests"; these representations "become political points of

struggle for control over the interpretive framework that directs land use and planning" (Hall et al., 2013, p. 122).

4.1.3 Practical experience and administrative knowledge

Administrative knowledge, as conceived by Stepanova (2013, p. 1670), exhibits "components of scientific, normative, and practical knowledge," and is "used in all forms of resource management and formally organized decision making in governmental and non-governmental organizations." Participant responses indicated a wide range of practical experience and administrative knowledge, with many members having previously participated on resource management boards or engaged with formally organized decision-making bodies. Experience on committees was understood by participants to be beneficial, as it afforded them a level of comfort in deciding the degree of their engagement in deliberations. A lack of experience was seen as a barrier to deliberation, with the farmers and other participants who did not have that prior experience taking a reactive or defensive stance. These nuances in participation are reflected in the literature, since having a diverse group of stakeholders does not guarantee the inclusion of their knowledge (Guehlstorf & Hallstrom, 2012), nor can it be assumed that all stakeholders are capable of engaging in fruitful deliberation (Ashwood et al., 2014). Whereas Smit et al. (2015) identified procedural barriers to deliberation, Ashwood et al. (2014) identified three contextual barriers: the rigidity or adaptability of the institutions involved in resource management, the willingness of stakeholders to situate their own identities and refrain from generalizing those of others, and the perceived distribution of benefits and burdens as a result of the management actions. In other words, the process can impact how deliberation–and the expression of knowledge–occurs, but previous experience on committees can have a significant influence on how participants engage in deliberation. While previous experience can be beneficial, there is no mention in the literature of how a lack of experience is seen as an opportunity for critical questions to be asked of the concepts employed by participants, and of the process itself. While most research focuses on the knowledge that is present, the role of skepticism in the literature is limited to political ecology (Robbins, 2000) or focuses on local knowledge (Davis & Ruddle, 2010).

From the 'Experience in an administrative or managerial role' aspect of practical experience or administrative knowledge, Leadership is a topic that appears in the collaborative planning literature. Leadership, as a human-relations skill learned or developed over time through specific work experiences, is highly valued by participants in this research. Participants

found that the Park resident (in conjunction with other members on the PLCWA Board) provided the support, outreach, and organization necessary to initiate and sustain the Pike Lake planning initiative. Both leadership and facilitation were cited as factors in ensuring fair and equitable deliberation, and ultimately to achieving consensus. Smit et al. (2015, p. 438) also found leadership to be "an important factor in the engagement of knowledge" in their research, with key members undertaking "activities that supported knowledge transfer and the translation of expert knowledge into every day terms" as well as outreach, promotion, and volunteer recruitment. Similar activities have been undertaken by the Park resident, Lessee #1, and Lessee #2.

One aspect of practical experience or administrative knowledge not addressed in the literature is the influence of lay knowledge, especially when "people's everyday interpretation of a situation" (Raymond et al., 2010, p. 1768) is based on 'practicality'. The results suggest that practical experience becomes a 'way of knowing', as it results in the interpretation of the planning process in fundamentally different ways by committee members with extensive managerial experience. While a practical approach may be necessary to avoid meeting fatigue and to achieve efficiency within the process, it also threatens to impinge on deliberation and representation by truncating discussions and restricting the complete representation and discussion of stakeholder concerns.

4.1.4 Scientific knowledge

Scientific knowledge is used here as a label that encompasses formal, explicit knowledge production in the 'natural' sciences. Participants referred to the scientific knowledge of other committee members as well as the knowledge held institutionally by the WSA in the form of historical instrument and infrastructure records. This 'evidence' was afforded legitimacy by comparing its immutable nature to the informal foundations of local knowledge. The fundamentally positivist or realist agricultural science described by Kloppenburg (1991) is echoed in the participant descriptions of scientific knowledge presented in the results. Claims to the legitimacy of scientific knowledge, made through the criticism of local knowledge, are complicated by the agricultural knowledge of local farmers described by participants. Furthermore, through reference to ecological theory, scientific knowledge becomes a value-laden problem-framing used to justify certain types of watershed management interventions.

Whereas Kloppenburg (1991) and Knapp & Fernández-Giménez (2009) refer to their agricultural and rancher knowledge types in terms of local knowledge, I have classified agricultural

knowledge as a subtype of scientific knowledge. The knowledge held by committee members from the farming community is undoubtedly local and experiential, but this type of "tacit knowledge provides the context—the meaning, priorities and values, or how we understand the world—while explicit [or scientific] knowledge provides the tools that we use to act upon that understanding" (Wolfe, 2009, p. 492). Thus, the way in which the farmers interpret local conditions is a combination of formal education and practical experience. The result is the application of some level of 'scientific rationality' to local knowledge, which is akin to the Rancher knowledge described by Knapp & Fernández-Giménez (2009). Their description focuses on three categories:

> active knowledge gained through management of natural systems for production, embedded knowledge gained through living in a particular place, and integrative knowledge of the interconnections between social, ecological, and economic factors. (Knapp & Fernández-Giménez, 2009, p. 503)

These categories match up well to the characteristics of knowledge held by the farmers. They are seen as being "successful" in their land management practices, are "embedded" either due to their multi-generational connections to place or life-long residence, and are well connected to the social, ecological, and economic pressures experienced in and by their communities.

4.1.5 Science and the ecological problem framing

Participants referenced three broad topics in ecology, using them to frame and interpret environmental phenomena in and around Pike Lake. References to ecosystem health were frequent amongst participants, but no criteria were discussed as to how that health is to be measured. Taylor & de Loë (2012, pp. 1209–10), referencing Carolan (2006), suggest that "ecosystem health is in fact a value statement that rests on beliefs about what we think nature should look like." 'Health' is also linked by participants to the carrying capacity of the ecosystem, yet this concept itself is often misapplied or misunderstood (del Monte-Luna et al., 2004).

The use of the term 'community' is also contestable since "[d]efining boundaries of biological systems in space and time is inherently difficult" (del Monte-Luna et al., 2004, p. 489); there are issues in defining a 'community' due to issues of embeddedness, interrelationships, and scale. In Ferreyra et al. (2008), 'community' is shown to refer to socially constructed boundaries that define a geographical area or spatial scale, either on a political or topographical basis. Although the Park resident identified multiple and embedded social communities, there were few

other mentions beyond the use of ‘community’ as a catch-all for the people that live near Pike Lake.

Another scalar concept present in the results is that of time. The time frames through which participants interpret environmental phenomena corresponds with the “observational scale” of measurement and sampling, the choice of which “critically affect the type of patterns that will be observed, because patterns that appear at one level of resolution or extent may be lost at lower or higher levels” (Higgins, Mahon, & McDonagh, 2012, p. 140). This corresponds to instances where participants noted social, economic, land use, or environmental change over time: newer residents made reference to dramatic changes over shorter time periods, whereas long-term residents commented on climate cycles or long-term human-induced environmental change.

4.1.5.1.1 Water management interventions

The problem framing established through the use of ecological theory is one in which the lake has been in poor ‘health’, and through the efforts of a certain community in the area–along with some cooperation from ‘nature’ in the form of plentiful precipitation–the ‘health’ of the lake has been improving. Even though these efforts are perceived as being successful, the Park resident suggests that “[t]here’re [still] big things to be done” to achieve a ‘healthy’ lake; the implication is that there are still many major interventions that must take place prior to the ecosystem matching “what we think [the lake] should look like” (Taylor & Loë, 2012, pp. 1209–10). This ecological theory-based representation of ‘place’ has framed deliberations throughout the planning process, but it is not the only interpretation held by committee members. Consider the comments of an elected official, who spoke to the way that the local ecology has changed over time, and will likely continue to change. Referring back to the “Representations of place” (Hall et al., 2013, p. 122) that stem from differences in local knowledge, when these “narratives and ideas about nature and society are mobilized, [they exclude] alternative interpretations and [disregard] political motivations…it speaks to a narrative that serves select groups and excludes others” (Rudestam, 2014, p. 23)(Rudestam, 2014, p. 23). Although the inclusion of different knowledge types is recognized by participants as important for the planning process, the inclusion of multiple narratives of the same area is not considered in the same light, even though those narratives are storied expressions of local knowledge that contribute to social learning (Hall et

al., 2013; Stewart et al., 2013), as well as to effective and equitable restoration efforts (M. Robertson et al., 2000).

4.2 Knowledge Types in the Planning Process

Broadly, the Pike Lake planning process, as with many watershed management initiatives, aims to foster cooperation amongst a diverse group of stakeholders for the purpose of long-term planning. The process requires the establishment of goals, as well as objectives to achieve them. The following section describes the ways in which different knowledge types complement, critique, or combine to influence the planning process.

4.2.1 Cooperation for long-term planning

Water policy and governance across Canada has been described as fragmented by numerous scholars (Bakker & Cook, 2011; Loë, 2009; Mitchell, 2005), and similar sentiments on Provincial governance and management have been raised at Pike Lake committee meetings and in the interviews. Uncertainty about who is ultimately responsible for water quality in the lake, for monitoring new residential developments, and testing for septic systems was only partially clarified by local government representatives who had the bureaucratic knowledge of the applicable regulations; responsibility for the enforcement of regulations was another issue brought up. Participants also expressed concerns over land use and management practices on farm lands surrounding the lake, which touches on the rights and responsibilities of private land owners. To better manage fragmentation and the intersection of private property with a common good (the Lake), cooperation between government agencies, non-governmental organizations, and the diverse stakeholders around Pike Lake is considered to be necessary for any type of long-term planning. Bureaucratic knowledge of the rights and responsibilities of stakeholders clarifies issues of authority and accountability (Ananda & Proctor, 2013; Margerum, 2007); having this knowledge represented can also potentially lower the 'transaction costs' of information retrieval (Widmark et al., 2013).

One elected official sees the Pike Lake planning process as an opportunity to "work *with* the government to make the changes, or *maintain* certain things." However, the elected official comments that cooperation is threatened by insufficient funding "designated [at the Provincial level]… for *long term* planning…it's year to year." Funding for planning is not the only concern, as is evident in the experiences of local government representatives when discussing funding and

cooperation with respect to infrastructure. Specifically, participants referred to the cost of road maintenance, which is currently borne solely by local ratepayers, even though cottage owners utilize those roads while "[contributing] nothing to our roads. They don't contribute taxation in any way, shape, or form" (Elected official). If stakeholders are aiming for cooperation, it will have to take place in many ways, including through financial contributions. The local knowledge of what has been done in terms of infrastructure maintenance, what needs to be done, and the costs associated with that infrastructure is necessary to establish an understanding of the distribution of costs and benefits within the area.

While bureaucratic knowledge and local knowledge enrich discussions of cooperation, it is necessary to acknowledge the administrative knowledge and facilitation experience that enables those discussions. Significant investments of time and effort have developed the organizational capacity and trust between stakeholders necessary to engage in deliberation:

> ten-twelve years ago there was a lot of conflict. There was always conflict resolution going on…bullying, all kinds of negative behaviours, and I really think with [the Park resident's] leadership, that's kind of changed some of that around, so it's more of a hospitable environment there now, meetings and so on. (Lessee #2)

Facilitation has supported deliberation and learning, which feeds back in to building trust and capacity within the planning committee. The Park resident comments on how time together as a committee is necessary to establish a common frame of reference; stakeholders must be able to talk to the same points and understand the concerns and interests of other committee members as a precursor to meaningful deliberation and discussion (Ashwood et al., 2014; Pahl-Wostl et al., 2007).

4.2.2 Inclusion and participation

The structure of the process and organization of meetings are important considerations for cooperation through inclusion and participation; bureaucratic knowledge, administrative knowledge and prior experience in watershed management are key considerations. As the Watershed engineer attests, "I think that how the meetings were ran and how they were facilitated I think people definitely should have felt that they could have got in their two cents at any time." Similar sentiments are held by an elected official, who said that the core group driving the organization of the process "do make an effort to try and get everybody at the table when they're having a meeting." Beyond efforts aimed at achieving high attendance rates, the small scale of

the planning process has allowed for meetings that differ significantly in structure from larger scale planning or management efforts. Whereas agency representatives often populate advisory or technical committees in larger initiatives, representatives in the Pike Lake initiative appreciated the opportunity "to [be] there at the table together all the time" (Watershed engineer). Area resident #1 has also typically taken on a technical role, and comments that he feels his time commitment has been minimal since he hasn't "been contributing in terms of where I have to go and dig and find a bunch of information and report back." This suggests that previous experience can be beneficial, by increasing the likelihood of attendance at meetings and allowing for a different perspective on similar processes, but also constraining by possibly leading to exclusion through limiting the type of input that participants may be most comfortable or accustomed to contributing. At the core of efforts to include stakeholders and encourage participation is the aim to distribute power through adequate representation (Margerum, 2007).

While the above examples portray the importance of having administrative knowledge or practical experience in watershed planning and management, there are benefits to having lay knowledge included in the process as well, both for the individual and for the group. Having an "uneducated mind" present means that Lessee #1 "can ask questions that a lay person would ask." The fact that this is a "learning experience" for those with limited experience in watershed planning means that there is an opportunity for group reflexivity, but only if those 'lay' questions are asked.

4.2.2.1.1 Discontinuity as a barrier

Concerns over the reassignment of government agency personnel were brought up in three of the interviews. For this planning process, the Park area manager was a welcome change (for some) from the previous manager, but he was unable to continue with the process after moving to a different city. Such changes are not infrequent, as the Park area manager attested to when referencing previous experiences in watershed management: "I came into the middle of [another management process], jumped in with both feet, and had to get up to speed pretty quick on that." While such a change can bring a fresh perspective, as it did in this planning process, the Park area manager recognizes that "it's hard for that [new] person to kinda pick up where I left off, basically." While these types of changes can be seen as the loss of a participant and the bureaucratic knowledge or local knowledge they hold, it is also an opportunity to gain a new

perspective or wealth of knowledge, even though significant effort may be required to bring the new representative 'up to speed' on the process. Frequent changes in government personnel means that relationships must be continually rebuilt, which may diminish the apparent trustworthiness of agencies (Sharp, Thwaites, Curtis, & Millar, 2013). This concern is related to the collaborative stability discussed by Margerum (2011), although that factor focuses on 'permanent' staff within a watershed organization rather than on the rotation or reassignment of government agency personnel participating in that agency. Trust between stakeholders, often measured as social capital, is integral for the functioning of a watershed organization (Plummer & FitzGibbon, 2006).

4.2.2.1.2 Practical experience as method

In the interviews, practical experience as a way of knowing was rendered in two distinct ways. As described by the Park resident, the "educational approach…where we engage, and we show patience…[to] make sure progressive steps are made and people are all on side" appears in direct opposition to the "kick in the butt" provided by those who exhibit practical experience as a method of practice. The level of involvement of those with practical or managerial experience could have profound implications on the planning process by altering the degree to which stakeholders are represented, thereby influencing the distribution of power (Purcell, 2009; Robbins, 2000, 2006). For example, the Park area manager's experience, and possibly his personality, resulted in other participants feeling that the risk assessment was somewhat rushed. Lessee #2 was concerned that this truncated deliberation will lead to questions of effective stakeholder representation: "I'm just wondering if we…were to take those [risk assessment rankings] to the people…whether exclusions, I guess, will be equated with errors in our committee's judgment." Summarizing the potential influence of the practical method of practice on the planning initiative, one elected official states that "at the end of the day, it's [not] gonna come down to 'what you want' but…'can you afford it?'."

The potential for exclusion resulting from a 'practical' method of practice echoes concerns of 'contained deliberation' and 'constrained participation' detailed by Reed & McIlveen (2006). The first concern is focused on "what counts as knowledge," control over "diversity in knowledge claims," and how social positioning is implicated in those decisions (p. 593-4). The

second concern is related to the first, but addresses power imbalances that "[result] in the marginalization and exclusion of disempowered groups in planning processes as well as their interest and systems of knowledge in planning decisions" (p. 594). The method of practice chosen by the committee–educational, practical, or some blend of the two–can have significant implications on the "diversity [of] knowledge claims" present in deliberations, especially with knowledge types that are tacit or implicit and not easily articulated, as may be the case with local knowledge. If more emphasis is placed on the practical end of the method spectrum, there is a real risk of power being exercised to marginalize committee members who are not given a chance to relay their concerns, interests, or values.

4.2.2.1.3 Decision-making

Knowledge of democratic processes, often associated with bureaucratic or administrative knowledge, also comes in to play with inclusion and participation. All stakeholders are concerned about achieving consensus, but not without reservations. Where representatives in official positions are hesitant to make firm commitments due to lack of authority, other members see the importance of roll call voting as good practice for record keeping. However, as the Park resident reflected in the interview, a "consensus decision is then reaffirmed by a vote." An understanding of options pertaining to democratic decision-making can lead to informed choices that will afford the initiative, and the committee, a sense of legitimacy amongst stakeholders. There are, however, diverse interpretations of consensus, as found by Rudeen et al. (2012) They reported that group size, diversity and divergence on issues, and open process structure impeded the likelihood that consensus would be reached. The authors concluded that a consensus model "[perceived] as legitimate and beneficial may have both positive and negative outcomes" (Rudeen et al., 2012, p. 1023). Roggero (2013) found a significant relationship between investment in the decision-making process and the final costs of implementation: greater effort in achieving consensus through participation and inclusion leads to lowered 'costs' of plan implementation.

4.2.3 Lay knowledge as a critical voice on the process

Lay knowledge was broadly characterized in contrast to other types of knowledge, with participants claiming that they do not: "bring the knowledge that you guys bring"; "know all that much about watershed groups like this one"; "have *any* real other experience" with watershed planning; or have any "formal education…in that kind of stuff." This characterization of lay

knowledge as a lack of knowledge is taken one step further by an elected official, who self-evaluates his knowledge as "useless", although his prior interactions with other committee members leaves him feeling that other members "see more value in my knowledge than I really do, but that's probably because they understand the process…better than I do." There is some uncertainty in this situation, however, as the official may be referring to the value placed in his local knowledge of the area, as opposed to his general lay knowledge. Raymond et al. (2010) describe a place-based aspect of lay knowledge, which reinforces the interpretation that the RM is discussing the perceived *expert* nature of his local knowledge rather than his lay knowledge.

4.3 Privileging Knowledge Types

This section explains how scientific knowledge came to be privileged in the Pike Lake planning process in a narrative style. The narrative for "Setting and achieving goals" is introduced in terms of a planning process, and then detailed below. The interpretation was based on two 'indicators': what people said, with data gathered through interviews; and what was observed of the process, through my presence as a participant observer.

4.3.1 Setting and achieving goals

Through deliberation and individual learning, the planning process is expected to result in substantive goals and objectives with measurable outcomes (Margerum, 2011). One measure for the clarity of goals and objectives put forward by Margerum (2011, p. 124, Table 5.1) is the formulation of "goals and objectives that are integrated." Integration refers to internal linkages between the plan and strategies for the committee, linkages to "the plans and approaches of other entities," and consideration of "the range of social, economic, and environmental factors" (p. 127). Such integration, Margerum contends, occurs when collaboration is able to reduce the impacts of traditional management 'silos'. Conceptually, the process relies first on the interpretation of phenomena; this interpretation then leads to the development of a vision, or ideal-type narrative, for the area. That narrative is used to justify specific interventions in the watershed; evaluation of the process and outcomes from the process are also couched in the language of the knowledge type used to interpret the original phenomena.

4.3.2 Interpretation of phenomena

The interpretation of phenomena varies between people, and one concept that can be used to understand the factors that influence interpretation is that of 'mental models'. Mental models

can be understood as "a relatively enduring internal abstraction of an external system to aid and govern activity"; these models "may be shaped by the role of actors in a social system, their personal, educational and cultural background as well as their previous experience and biases" (Pahl-Wostl et al., 2011, p. 853). Mental models are subject to change, especially through learning processes that arise with communication. When committee members share similar backgrounds, their models are likely to be compatible or "convergent" (Pahl-Wostl et al., 2011), which leads to similar interpretations of phenomena, and approaches to management of those phenomena. In discussing knowledge co-production, Armitage et al. (2011, p. 999, Table 3) discuss the role of interpretation, finding that "[i]nformational knowledge must be interpreted[,] bringing into play different worldviews. Even where data gathering is collaborative, analysis/interpretation may not be. Even where there are generally shared goals, there may be different assumptions – observations may converge, interpretations diverge." The level at which Pike Lake committee members are working from the same set of "informational knowledge" is uncertain, and even though committee members refer to the same environmental or climatic events, they are applying different interpretations: "I'm always amazed at sometimes the things that people say…I don't know where they come from, they're not science-based…there's some pretty different ideas about where that water came from…and how high it's gonna get" (Lessee #2).

Even though the Park resident and Area resident #1 commented on occasions where local knowledge conflicted with scientific knowledge, they concluded that the conflict was not so dire as to warrant an in-depth explanation to other participants: it was not "a hill for anyone to die on." Essentially, they perceived that the likelihood of learning occurring was low:

> I know one time I could have maybe pushed a point about some aspect of habitat, but because maybe some of the people around aren't familiar with that kind of information, you could spend a whole bunch of time trying to explain it to them, and-and y'know, they'd have to take that back and digest it, and they still might not agree with you in the end. (Area resident #1)

The choice to engage in deliberations strategically indicates prior experience in resource management, especially when considering the previously tense stakeholder relationships in the Pike Lake area.

For Area resident #1, he feels that his previous experience in watershed management and planning, combined with his academic training, could be of "help with finding resources for water quality assessment, or…any of those kinds of things" that are pertinent to the scientific

interpretation of local environmental phenomena. Similarly, the Watershed engineer is seen as having "good knowledge of pumping systems and-and his experience with that helped us understand that process [of how the WSA manages the water levels] better" (Park area manager). These types of interpretations, based on Western science, prove to be the foundations of the ecological narrative that drives the Pike Lake process: the gauging of water quality through biological or chemical indicators, the design and operation of water pumps to maintain certain levels, and the use of theories related to landscape change and disturbance to explain environmental change.

4.3.3 Ecological problem framing

The potential epistemological conflict between knowledge types such as local knowledge and scientific knowledge can lead to power struggles over problem framing. Results from Taylor & Loë (2012) indicated that some participants saw a role for local knowledge in framing the issues to be dealt with in the planning, but others held reservations about the value in doing so. Smit et al. (2015) found that participants saw goal setting as the domain of experts, though local experts (as local knowledge holders) were seen as contributing somewhat to goal setting. While Robertson et al. (2000, p. 120) describe local knowledge through 'environmental narratives' as "stories that are bounded by the narrator's particular experiences, observations, and attachment to place," these narratives are not restricted to local knowledge holders, nor are they exclusive of scientific knowledge. From the description above, environmental narratives can reflect any type of situated knowledge, scientific, local, or otherwise. What is evident in participant interviews was the role of scientific knowledge in developing a dominant environmental narrative for the planning process.

Throughout the interviews, the phrase "health of the lake" was frequently mentioned. This phrase conceptually encompasses what is perceived to be the lake ecosystem, but extends beyond the 'natural' to include social components: "what we want is a healthy lake, ecologically and recreationally well into the future" (Park resident). The concern with a multifaceted ecological "health" of the lake and surrounding area becomes the justification for intervention as a stewardship ethic: "And bearing in mind the ecosystem, to make sure it's maintained, I think that's important" (Elected official). This ethic is again masked by the discursive use of the term "ecological health", with Lessee #2 describing the lake as in need of care and attention: "everybody has the lake as the patient." By framing the goals of the planning process as aiming at

achieving an ecologically (and recreationally) healthy lake, the implication is that currently the lake is in a state of poor health.

From the interviews, it was evident that the causes of an impaired lake were: a history of neglect of the lake and surrounding lands by Park management and Provincial ministry of Parks, Culture and Sport generally ("Parks have not taken the lake seriously, over the last decades" - Park resident); changes in land use and land management practices by farmers around the lake ("I know there's been some channel clearing and some ditching" - Area resident #1); and actions by lessees and cottage owners ("people haven't been shootin' holes into the bottom of the septic tanks [laugh] where it's leaching into the groundwater. Those sorts of things, I think, aren't such a deal now, but they may have been 20 years ago by the sounds of it" - Area resident #1). The formation of the PLCWA was seen as the beginning of a time of reform for the mindset of people in the area, which "used to just be 'go out to the lake and do whatever you want'" (Lessee #1). This attitude is seen as pervasive in area residents:

> from what I gather, they tend to be more "do what you want" rather than…not rule followers, but they wouldn't be members of the group that I think would do us a lot of good, cause they're too used to going off on their own and doing whatever they want. (Lessee #1)

This statement touches on concerns of sovereignty over private property, and relates to committee concerns of influencing land use and development on private land. Similar issues are seen in the literature (Ananda & Proctor, 2013).

Scale has an influence in terms of problem framing. The Park resident assessed the issues within the Pike Lake area in terms of "the big picture of a healthy, ecological and…recreational lake. There're big things to be done." Time scale is also a component of the narrative, appearing as a desire for the lake to achieve a "sustainable" state for "future generations." Long-term thinking about the "health of the lake" is a concern attributed mostly to permanent residents, whereas the recreational users are assumed to be less concerned about the future state of the lake and more interested in the immediate maximization of its usefulness. The Park resident ponders on those big things to be done, stating that "[there are] things that we can do *now*, if we do them, we can come close to reaching that [healthy lake]. If we don't do them, when are they gonna get done?"

4.3.4 Critical voices

Local knowledge can have multiple roles in watershed planning and management, such as: contextualizing "management options" and "monitoring programs," "qualitatively assessing the validity of scientific arguments, data and underlying assumptions" (Smit et al., 2015, p. 430); to guide scientific inquiry and corroborate findings (Calheiros et al., 2000); establishing baselines for restoration activities (Mustonen, 2013; H. A. Robertson & McGee, 2003; M. Robertson et al., 2000); supplementing scientific techniques used to identify ecosystems (Pitt et al., 2012); and providing a 'holistic' approach for research (Semken et al., 2011). The preceding list is not exhaustive, but does reflect a wide range of possibilities for local knowledge. By questioning the "underlying assumptions" of scientific knowledge, corroborating or contradicting scientific hypotheses, framing research holistically, and providing contextual details not accounted for by existing techniques, local knowledge can provide powerful critiques of the planning process and arguments employed by the committee. Smit et al. (2015) note that this opportunity is recognized in the literature, but the hybrid knowledge held by *their* participants excluded them from concluding a specific critical influence of local knowledge or lay knowledge on the process.

Having committee members with local knowledge or lay knowledge present does not ensure that those critical arguments are made: "I don't know much about a lot of the…ecology and all of those kinds of things…but I *can* ask questions that a lay person would ask" (Lessee #1, emphasis added). Procedural consideration of local knowledge or lay knowledge by itself may not be enough to elicit a critical voice. According to one elected official, members from the PLCWA have "asked me questions about the environment and…what my perception is of what they're doing" *outside* of the planning process. The official's take on ecology, change, and human intervention were noted at length in Section 3.1.8, and indicate the importance of having local knowledge included in planning as a means of reflecting on the planning committee's actions.

4.3.5 Intervention

From the transcripts, ecological terminology—an expression of scientific knowledge—becomes a way of describing the goals of the planning process in terms of an intervention into the environment. Lukacs & Ardoin (2014, p. 66) referred to the use of scientific language in a positive light, suggesting that it can "provide vocabulary for threats to place…thus adding a scientific lens and transparency to future place narratives." Rhoads et al. (1999) found that planning

and management in a highly modified landscape required trust and respectful translation of scientific knowledge to alter the dominant land management ethic, indicating that scientific understandings and terminology may inhibit collaboration and cooperation. Intervention as part of a stewardship ethic often occurs in place-making or place-remaking efforts (Lukacs & Ardoin, 2014). Smit et al. (2015) identified scientific knowledge as key for monitoring the results of an intervention, yet their findings did not extend to the role of scientific knowledge in determining the management actions. Although not focused on watershed management, Robbins (2000) found that forest management by the state was focused on specific outcomes (percentage forest cover), measurable through remote sensing. Managing to specific targets, as opposed to managing to the needs of resource-dependent residents, was identified as the "[invocation of] 'science'" to achieve political ends (Robbins, 2000).

A key consideration with respect to why this planning initiative started is that the WSA operates Pike Lake as a reservoir, with phrases from the Watershed engineer such as "operating the works" and "filling the lake" suggesting that management is from a fundamentally scientific approach. According to the Watershed engineer, the WSA has five specific targets for water elevations, which were set in 1995. The Fully Supply Level (FSL) is 481.94 metres above mean sea level (mamsl), the Minimum level is 481.40 mamsl, and three targets are set for the summer months: 481.55 mamsl on June 15, 481.65 mamsl on July 15, and 481.75 mamsl on August 15; each increment (0.1m) is equivalent to approximately four inches. The committee does not consider these targets as meeting the wants and needs of *all* stakeholders. Even though the WSA has "always been *way* above those targets…[and] haven't completely followed them," the Watershed engineer feels that the recent years of heavy rainfall have conditioned some stakeholders to expect water levels at or above FSL year-round. These targets have been set specifically to meet the timing and volumetric water "needs" of those who irrigate out of the lake, and do not necessarily reflect the recreational and aesthetic "wants" of seasonal users or local residents.

Activities such as pumping water from the SSR into the lake, or opening the north dam to drain water from Pike Lake into the SSR seem simple in and of themselves, but in reality are undertaken as parts of complex interventions that span both time and space. Two river-side pump sites and their associated supply canals preceded the current setup, each failing due to shifting sand bars and stream meandering. A spur dike was constructed in the river, with the intention to "train the river to come over to the west side to our pump site" without the river "coming over

too far where we start to have significant erosion" (Watershed engineer). Such engineering complexities are not widely understood by the stakeholders, which is evident in some of the comments from the Watershed engineer:

> I think alotta times just dealing with the general public, they don't have that understanding as to, well, why the water level *can't* be at Full Supply Level all the time. Like, they just don't understand *why* it can't be just sitting parked at that 481.94 and never move a centimetre above or below that. …from evaporation to-to water use...on and on, and obviously all the issues around the pump site as to why it can't be parked at that elevation.
>
> I think [the planning process is] a good opportunity for us to explain some of the complications and issues that we have to deal with.
>
> …hearing what stakeholders out there have for ideas or comments, and hopefully providing a little sense of reality, maybe…to some of the ideas out there. …not to say that anyone on the working group now has been unreasonable at all.

The above comments show that the respectful translation of scientific knowledge identified by Rhoads et al. (1999) is clearly an important consideration in watershed planning.

While highly regarded for the sense of place it engenders amongst residents and visitors alike, Pike Lake is not a pristine, untouched, or otherwise 'natural' ecosystem. It has a long history of modification, including dredging, sanding, beach additions, artificial supply, damming, and drainage; the lake itself is primarily used for human recreation ("that whole park *exists* because of that lake. It's a *recreational* park, because of that lake" - Park resident); and the surrounding land uses are either productive agriculture, residential, or recreational. Further interventions will focus on the human dimension of resource management, specifically the community, by attempting to influence how people use the lake, what people do on surrounding lands, and how the Park lands are managed.

4.3.6 Influencing management practices

Research into influencing river interventions in highly modified watersheds by Rhoads et al. (1999, p. 304) yielded the concept of 'naturalization', which "acknowledges that the concept of 'natural' is a social construct and that each community socially negotiates an appropriate mix of human and biophysical components in the local landscape." This concept allows management committees an opportunity to adjust their planning goals to meet both biophysical (scientific/ecological) goals of some stakeholders and the social/economic goals of other stakeholders. If the aim of the committee is to "preserve and enhance" or "*improve* what we have, and *maintain*" the

local environment to some desired state (Elected official), it will be important for them to acknowledge that the planning process is still subject to personal "desires for how the lake might be developed" (Area resident #1). The WSA takes a similar stance, and is looking to make use of this planning process to "establish a new range [of lake level targets] that…closer reflects what we're doing …but then takes into consideration what the stakeholders out there want and need" (Watershed engineer). These desires, or wants, include goals that focus on "ecological and recreational health," as well as goals that meet the needs of agricultural producers to reduce the negative impacts of lake level management on the surrounding farmland.

Through setting biophysical criteria with which to judge goals, objectives, and outcomes of the planning process, scientific knowledge is deployed to pressure land managers to alter their practices. Through his career with an environmental non-government organization, Area resident #1 has extensive experience in engaging stakeholders to effect such land use change to achieve conservation targets. His comments on the impacts of land management practices on local ecosystems reflect the potential influence of biological, hydrological, and ecological knowledge on the management actions of the watershed plan. Through the use of remote sensing and the application of various analytical techniques, "you can really start to learn on the nature of a wetland by tracking it through wet and dry cycles." Similarly, air photographs can be used to monitor land use change, as it relates to agricultural land management practices, since "you could see what was drained into these remaining wetlands over time, or what ditches are put in to make an area better for farming…or…if they passed all their water onto their neighbour." The use of scientific knowledge to gather evidence of land use change and assess the impacts of land management is not contested in the interviews, but it is still important to ensure that "if you're designing a watershed plan, *they're* [farmers] involved" (Area resident #1).

While participants did not comment on the potential pitfalls of using scientific knowledge to effect broader changes in land use and management, there may still be some resistance to the implementation of goals, objectives, or actions that are based solely on scientific knowledge. Rudestam (2014, p. 32) suggests that when differing narratives of place clash, especially when it relates to questions of ethical stewardship, "landowners would be resistant to making changes that would affect their livelihoods or their relationships to place." No explicit evidence of this potential resistance exists in the transcripts, although it is implied by Lessee #1: "I'm not sure that, when we do get this report from [the WSA], that [everyone is] gonna agree to it."

4.3.7 Language of logic and evaluation

In terms of logical and sound objectives, Margerum (2011, p. 124, Table 5.1) identifies "clear goals and objectives" as a factor in achieving a "high quality" product of collaboration; measures of that factor include: "clear goals agreed to and supported by stakeholders; objectives that clearly specify measurable outcomes; goals and objectives that are integrated." Perceptions of success, however, may not be tied directly to achievement of consensus, or even to the implementation of the plan (Rudeen et al., 2012). One elected official highlights the importance of having diverse knowledge types at the planning table in order to "make a rational decision" on management goals and actions. While a rational decision is seen as desirable, complete agreement with finalized management actions is not expected by participants. Yet there is still an assumption that the community will "buy in" to the plan if it contains "logical steps," or if the "objectives are logical and sound." The concepts of logic and rationality are seen as fundamental for success, if success is to be evaluated as having broad-based community support for the plan's goals and the management actions proposed to achieve those goals.

Following the explication of different types of rationality laid out by Alexander (2000), it is evident that simply stating that a decision is "rational" or objectives are "logical" is insufficient, as it erases the influence of 'situated' knowledge. Both the context in which those decisions are reached and objectives agreed upon and the people involved in making those decisions play critical roles in establishing the type of rationality applied. For a consensus decision, rationality is assumed to be based on communication (Alexander, 2000; Healey, 1996), but this is dependent on the process achieving an ideal state of unbiased deliberation. Ultimately, how each stakeholder evaluates the logic and rationality of the plan will depend on an interpretation based on their own subjective understandings of rationality, their values and interests, and their experiences within the planning process.

4.4 Summary

All four knowledge types were found to reflect the broader literature, although differences in how they are characterized and their perceived role are apparent. The role of knowledge in the Pike Lake watershed planning initiative was seen in two over-arching themes: cooperation for long-term planning, and the setting and achievement of goals. Cooperation for long-term planning focused on the importance of inclusion and participation for knowledge integration, as

well as complications that may arise; the critical role of lay knowledge was also recognized. Different knowledge types influenced how goals were set and evaluated through: influencing the interpretation of phenomena, framing the planning 'problem' in terms of ecology, declaiming a need for critical voices, maintaining an interventionist approach, influencing management practices, and establishing a language of logic to evaluate success. Committee members expressed their knowledge in various ways to either support or contest how environmental phenomena are to be understood, setting the stage for the domain of management actions. Although the importance of a critical voice was highlighted, the foundations of those critical voices were deemed to be unscientific, and thus unreliable and inadmissible as evidence. Ultimately, scientific knowledge was used to establish the dominant narrative as well as the evaluative criteria; the result is a narrowed set of possible outcomes from the process.

5 CONCLUSION

This chapter concludes the research by discussing the significance of the findings and the contributions of the research to watershed planning, identifying the limitations and potential for future research, and providing recommendations for future collaborative watershed planning processes.

5.1 Significance

A total of nine committee members from the Pike Lake planning initiative were interviewed for this research to explore the role of knowledge in the planning process. The analysis of results identified knowledge types present amongst committee members, and also explored the influence that knowledge had on various factors in collaborative planning. Identified knowledge types of bureaucratic knowledge, scientific knowledge, and local knowledge aligned with those found in the literature, although minor discrepancies in description and characterization are present and inevitable. One example within the literature is that practical experience and administrative knowledge are typically separate, with practical experience understood either as lay knowledge or an aspect of expertise, and the characteristics of administrative knowledge seen as aspects of bureaucratic knowledge. Significantly, knowledge types were not found to be mutually exclusive. People have attributes of multiple knowledge types to varying degrees; they are also able to interpret changes in their local environment through varying combinations of those knowledge types.

In terms of the interaction between knowledge types and the planning process, the analysis explored how different knowledge types are important for collaborative planning through two over-arching themes: cooperation for long-term planning, and goal setting and achievement. The theme of cooperation for long-term planning touches on two factors. The first factor, inclusion and participation in the process, included issues related to continuity of agency personnel and the potential impacts of staff turn-over, how practical experience can significantly influence inclusion and participation, and the way that previous experiences in democratic decision-making processes can influence how people participate in them. The second factor, critical voices in the process, described the potential role of lay knowledge in posing naïve questions of the process, goals, and actions to encourage both individual and group reflection on the process.

The second theme, goal setting and achievement, describes a sequence of events—similar to a planning model—in which different types of knowledge are integral to the substantive portion of the planning process. This sequence begins with the interpretation of environmental phenomena, which leads to a context-specific problem framing, which is then refined by critical voices spurring reflection. Once the problem has been framed, a set of interventions that may rely on influencing management practices are developed. The final step is that of evaluation. The discussion section highlighted the dominance of scientific knowledge in this sequence by: establishing itself as the acceptable 'way of knowing' environmental phenomena; framing the 'problem' in terms of an ecology that is based on a nebulous definition of the 'natural environment' and in favour of specific uses of the lake and surrounding area; allowing for the critical voice of local knowledge while simultaneously discrediting its foundations; serving as the basis for interventions determined by the limitations and potentialities of engineered solutions; establishing management actions based on principles of hydrology, geology, biology, and chemistry, with *consideration* of the "wants and needs" of area residents; and evaluating the success of the initiative in terms of a specific 'language of logic' that accompanies a rational, scientific approach to management.

5.2 Contributions

The literature on watershed planning and management cautions against assumptions of inevitable and equitable knowledge integration in collaborative planning (Ashwood et al., 2014; Raymond et al., 2010; Smit et al., 2015; Taylor & Loë, 2012); this research confirms the findings in the literature. Going further, this research shows how the privileging of scientific knowledge can lead to the discounting and exclusion of local knowledge, even if local knowledge is claimed as valuable to the planning process by committee members. This finding suggests that greater attention must be paid to how planning occurs, specifically to ensure that equitable knowledge integration is supported. Efforts to understand the potential role of scientific knowledge in discursively framing the planning process as an ecological intervention are absent in watershed planning literature. This type of analysis is typically constrained to writing on watershed management, and even then a critical reflection of knowledge and power appears to remain in the realm of writers taking a political ecology approach to their analysis (Robbins, 2000, 2006).

It is evident that the inclusion of different knowledge types in governance can improve the understanding of local context (Bartel, 2013); this inclusion of local knowledge, and honest efforts at knowledge integration, can reduce the resistance of local landowners to the application or enforcement of watershed policies or management actions (Rhoads et al., 1999). Results from this research highlight an opportunity for WSA to revisit their planning model in order to fully recognize the importance of local and other knowledge types in watershed planning. The potential modifications include providing more guidance for small-scale or community-based planning initiatives, specifically when seeking to incorporate local knowledge into planning activities.

I presented an overview of the Pike Lake planning process at the "Long Term Threats to the Saskatchewan River Basin" Conference in October 2014; other presentations, by participants in the planning process, to similar professional audiences could provide other water managers an opportunity to learn from the Pike Lake initiative. Another option is for the WSA to establish an alternative to the SWP-focused process described in their *Watershed and Aquifer Planning Model* (n.d.). The model could be founded on principles of community-based research, with a strong focus on equitable knowledge integration through the democratic selection of planning activities and a thorough evaluative component.

5.3 Limitations and Future Research

The size of the area under consideration for management resulted in a small group of stakeholders and representatives, limiting the number of possible interviewees that could comment specifically on the way different types of knowledge were integrated in the initiative. Expanding the sampling population to include individuals that have prior experience in watershed management and planning could have yielded different insights into knowledge-based power relationships that exist in the community, but these would not necessarily have related to the activities of the Pike Lake planning initiative.

This research did not seek to isolate knowledge sub-types, which is a potential avenue for future research. Fine-grain understandings of LSK, LEK, and agricultural forms of local knowledge would benefit from an exploration of the multi-generational knowledge held by long-term residents of Pike Lake, as well as the knowledge held by medium and short term residents. Research into how varied length of relationships between stakeholders and the environment influences different aspects of local knowledge would provide an opportunity to enrich the body of

literature on local knowledge through the integration of concepts traditionally reserved for TEK. Furthermore, there are opportunities for research on stakeholder engagement at the community level, such that the specific activities or tools deployed in the planning process can be evaluated for their efforts towards achieving procedural goals of inclusion, participation, and equitable knowledge integration. A multi-case study might identify common barriers to equitable knowledge integration at the community level, if other communities were to undertake a similar planning process.

5.4 Recommendations

The following recommendations are made based on the combination of personal observations of the planning process, interviews with committee members, and the literature review. Alterations to the planning process that can help implement those recommendations are included below. The first recommendation is to ensure that the general knowledge types identified in this research are represented by different members in the watershed planning committee. Recognizing that people can hold multiple types of knowledge, the key goal is to aim for a diverse range of knowledge from within the community while still including representatives from the appropriate provincial agencies. The second recommendation is to present a range of participatory planning activities for the committee to consider. When selecting planning activities, close attention must be paid to the types of knowledge the committee is seeking to engage, the range of committee experience amongst members, and the goals of the planning process. Taking a systems-approach, some knowledge types in this process—and in others—may be justifiably privileged, depending on the goals of the planning process and the specific role to which it is being employed (scientific knowledge for water quality concerns, administrative for organizational capacity). This recognition does not counter the importance of including representation of all knowledge types possible, but serves to clarify the potential role of those knowledge types within the process. To reiterate, privileging of knowledge types is not always a negative situation, as different types of knowledge are critical to the planning process. However, reflexivity is necessary to ensure that privileging of certain knowledge types does not introduce bias in the process.

Drawing on the literature review, results, and discussion sections, in combination with interactions and observations at committee meetings, I propose two alterations to the activities within the existing planning model (see Table 5.1): the addition of an evaluative component (ex-

ante and ex-post); and the inclusion of options for alternative activities within Stage 2 (Complete Watershed Assessment) in the process.

5.4.1 Evaluation

Although the model includes a review of the plan, this does not represent a formal evaluation of the process. While the structure of a formal evaluation is beyond the scope of this research, even a simple assessment of knowledge integration would assist in ensuring the initial appraisal of knowledge types provided an effective base of knowledge for the planning process. The evaluative component would include two general surveys, to be conducted by the coordinator or facilitator; an external or third-party evaluator may be required, depending on the facilitator's experience and perceptions or concerns of bias (Gunton, Rutherford, et al., 2006).

An evaluation of knowledge integration would begin with a general survey of *all* stakeholders to identify where they feel they can contribute most to the plan development; this would take place in Stage 1, after the committee has been established. This type of appraisal can help the committee identify possible constraints in the initiative, moving it closer to a satisfactory outcome. Objectives for this evaluation are to: generally identify the presence or absence of the four broad knowledge types identified in this research; identify where participants feel they will be able to contribute the most in the process; and solicit perceptions of different knowledge types to better understand the potential barriers to knowledge integration. Committee members would be asked specifically for an assessment of the role they see the different types of knowledge fulfilling (Smit et al., 2015; Taylor & Loë, 2012); once the initial cycle of the process has been completed, participants would be asked to self-evaluate their most important contributions (Stage 5, upon review of the watershed plan). The objective is to assess the efficacy of the planning activities in achieving equitable knowledge integration: how stakeholders perceive their input being received and valued, as part of the deliberations in the process, can be used to assess the quality of integration resulting from the selected activities. However, in the absence of a formal evaluation, the committee should avoid the declaration of causal linkages in the 'program logic' (i.e. in response to the final survey, participants may state that their knowledge was not included in the process; the facilitator might conclude that the planning activities chosen were not appropriate though there may be multiple and interacting causes). Having representatives for each knowledge type, allowing for overlap, can help to reduce the negative influence of the factors related to collaborative planning as identified in the literature review. The results of the evaluation

would help identify strengths and weaknesses, in terms of knowledge, of the committee, providing an opportunity to ensure that appropriate steps can be taken for the next cycle to include appropriate knowledge holders, and to select activities for the process. This recommendation follows the structure of planning processes from previously cited references (Raymond et al., 2010; Smit et al., 2015; Taylor & Loë, 2012).

Table 5.1: Modified community-based watershed planning process.

	Original	*Modification*
Stage 1: Working Committee	Establish a Working Committee of broad stakeholder interests. In an initial meeting consider details of terms of reference including meeting schedule, quorum, decision-making process (majority or consensus model), chairperson appointment, relationship to government agencies. Identify goals and objectives of the future watershed plan through broad public engagement.	**Evaluation component** Goal: identify possible constraints in the initiative. Activity: after formation of the committee, a survey is conducted to identify knowledge types present (Raymond et al., 2010), and perceived role of participants and their knowledge (Smit et al., 2015; Taylor & Loë, 2012).
Stage 2: Watershed Assessment	Undertake an assessment of watershed characteristics (physical, social, technical, institutional, etc.). Identify issues and concerns from all stakeholders including park visitors, residents, farmers, government, etc.	**Knowledge integration-specific activities** Goal: to facilitate common problem identification and discovery of interdependence, specifically at the beginning of the process. Activities: field visits or tours to engage committee members and provide experiential learning (Bouwen & Taillieu, 2004; Luyet et al., 2012); participatory modelling of watershed hydrology to integrate fine-grained local knowledge with generalized scientific knowledge (Pahl-Wostl, 2002); participatory mapping exercises to further integrate local knowledge (Debolini et al., 2013; Wolfe, 2012).
Stage 3: Management Actions	Identify management actions that are required to address the issues and concerns identified in the watershed assessment consistent with the goals and objectives of the plan (Stage 2).	No change.
Stage 4: Implementation Strategy	Develop an implementation strategy that will bring action to each of the identified management actions noted in Stage 3.	No change.
Stage 5: Plan Review	On a five year cycle the plan will be reviewed to update all aspects of the plan (Stage 1-4). Membership of the Working Committee to be updated; any new or revised information concerning the watershed assessment to be noted; revision or addition to management action to	**Evaluation component** Goal: inform future iterations of the planning process in terms of knowledge representation by adjusting stakeholder inclusion and planning activities. Activity: After reviewing the watershed plan, participants are surveyed for a self-

	Original	*Modification*
	be made; any changes to the implementation strategy to be noted. Generally, the goals and objectives of the plan will be reviewed for their accuracy, appropriateness, any major changes or additions will require public notice and engagement prior to adoption.	evaluation of their contributions (Taylor & Loë, 2012).

Note: Modified from R. Patrick (Personal communication; see Appendix B).

5.4.2 Planning activities

There are many possible activities for use in watershed planning, the choice of which depends on the facilitator, context, process model, and acceptance by the committee; different activities, or techniques for engagement, are associated with varying levels of participant involvement (Luyet et al., 2012). These activities attempt to incorporate the values, beliefs, and knowledge of stakeholders into water management; some examples follow. Participatory watershed modeling can incorporate local knowledge of hydrological activity with scientific techniques to help stakeholders generate a shared mental model of watershed function (Pahl-Wostl, 2002). A field visit at the beginning of the initiative is also highly recommended; occasionally revisiting the "field" can also help with keeping track of changes, and reminding stakeholders of the physical reality they are managing. Local spatial mapping also provides an opportunity to develop a refined understanding of local geographic context pertaining to water management (Debolini et al., 2013).

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Appendix A: INTERVIEW GUIDE

Background information

1. Do you live in the Pike Lake area?
   (a) If yes, how long have you lived here? What brought you here?
2. If no, what is your relationship with Pike Lake? How long have you been involved in the community?
3. Do you work in the area?
4. If yes, what do you do? How long have you done it for?
5. If no, where do you work? What do you do? How long have you done it for?
   (a) If retired, what did you do prior to retirement? How long did you do it for?
6. What are three things you like about Pike Lake? Three things you dislike, or negative aspects of Pike Lake?
7. What are the 2-3 biggest changes you've seen in the community or the lake over the last 5 years? 10 years?
8. What do you think are the three main challenges facing Pike Lake?

What "type" of knowledge is present, and how is it being used?

9. How did you become involved in this planning process? Why did you agree to sit on the committee?
10. Think of this question as a self-evaluation of your contributions. What can you offer the planning process?
    (a) Do you have any previous experiences that are applicable to the planning process? (council position, work-related, previous participation in an organization, applicable education)
    (b) What do you think would be your most important contributions?
    (c) How do you think you will benefit from participating in the process?

- In academic writing, the word 'knowledge' has many different meanings and definitions, and there are many ways to describe the different characteristics of knowledge.

11. Whether based on life or work experiences, formal education, and so on, what kinds of knowledge do you bring to the planning initiative?

- Now that we've looked at your participation from an internal perspective, such as your reasons for participating and what you bring to the table, I'd like to gauge your views on how the contributions from other participants fit into the planning process. Interaction and participation are key concerns in the plan-making process, especially when attempting to ensure

that all stakeholders are represented equally. Think back through the committee meetings you attended and try to recall details about how committee members interacted or participated.

12. Does anything stand out?
    (a) If yes, what made the situation stand out; when did it happen; what was the topic; who was involved
    (b) If no, was there ever a time where you thought a stakeholder group or committee member was over-represented? (what made the situation stand out; when did it happen; what was the topic; who was involved)
        i) What about under-representation of a group or committee member?
        ii) what made the situation stand out; when did it happen; what was the topic; who was involved

- We were talking earlier about your experiences in general and how they might influence your participation. The same idea applies to other people in the group. Given what you know about the backgrounds of the other participants, I want to know how you see their knowledge and experience influencing their participation and contributing to the process.

13. What are the other group members bringing to the table? (e.g. previous experiences with government or group activities, positive/negative experiences with individual stakeholders or other groups, active engagement in community, etc.)
14. What are the pros and cons of having these different types of experiences at the table?
    (a) Where do those experiences fit best in the process?
        i) what kind of experience; what makes it appropriate

What influences the flow of knowledge within the process?

The final set of questions is focused on the watershed planning process. Your feedback for this section will help identify the ways that the activities within the process can be altered to meet the needs and expectations of group members.

- There are a variety of viewpoints, ideas, concerns, and positions amongst the stakeholder representatives, as well as amongst the stakeholders in general. A collaborative planning process, such as the Pike Lake initiative, is meant to be a kind of forum for the exchange of viewpoints, ideas, etc. in the hopes of coming up with a better understanding of the issues at hand. I'm interested in your opinions of how well the planning process incorporated the viewpoints of the committee members and the stakeholder groups they represent.

15. What has helped to make it an inclusive process thus far?
16. What has restricted inclusion?
17. What do you think was lost as a result?
18. How has your understanding of the lake and the stakeholder community changed?

- Beyond the constraints of how the process is structured or how the meetings and are organized, sometimes people simply choose not to speak up or participate. This is also an important consideration in planning, since it can significantly alter the outcomes, as well as influence the individual experiences of the planning process. Again, think back to the committee meetings.

19. Was there a time where you had more to say but did not?

    (a) If yes, tell me more about it

        i) when was it; what was the topic; what kept you from speaking up; what would you have said

    (b) If no, was there a time where you said more than you think you should have?

        i) when was it; what was the topic; what did you say; what should you have not said That brings us to the end of the questions.

20. Is there anything else you'd like to add that you think I've missed, or that you feel is important with respect to knowledge in the planning process?

Thank you!

Appendix B: WATERSHED PLANNING MODEL

To: Pike Lake Stakeholder Group
From: Bob Patrick, PhD
Associate Professor U of S

Date: November 18, 2013

RE: Pike Lake Watershed Planning Framework

Please see attached Figure 1 and explanatory note below to describe a potential watershed planning framework for use by your organization.

Proposed Watershed Planning Framework

STAGE 1: Working Committee. Establish a Working Committee of broad stakeholder interests. In an initial meeting consider details of terms of reference including meeting schedule, quorum, decision-making process (majority or consensus model), chairperson appointment, relationship to government agencies. Identify goals and objectives of the future watershed plan through broad public engagement.

STAGE 2: Watershed Assessment. Undertake an assessment of watershed characteristics (physical, social, technical, institutional, etc.). Identify issues and concerns from all stakeholders including park visitors, residents, farmers, government, etc.

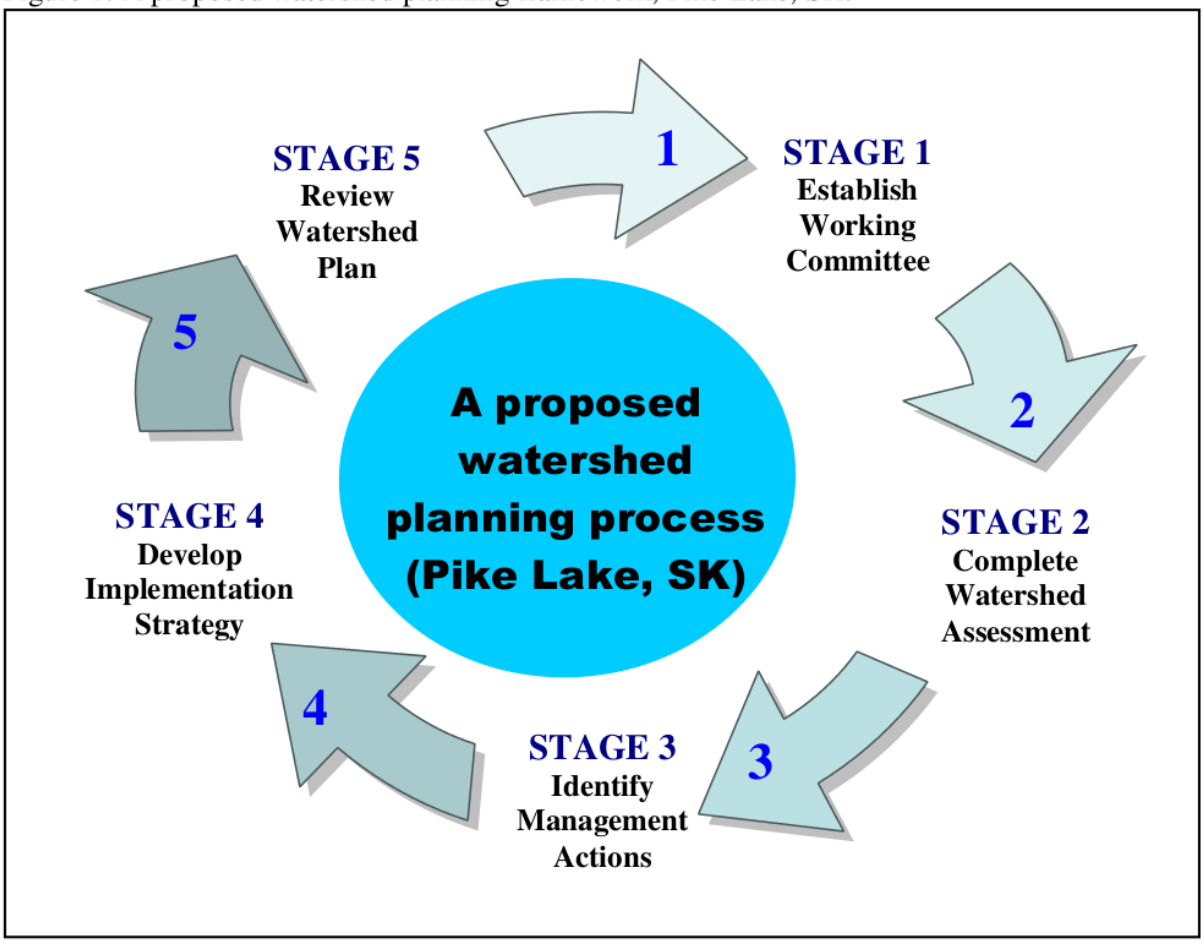
STAGE 3: Management Actions. Identify management actions that are required to address the issues and concerns identified in the watershed assessment consistent with the goals and objectives of the plan (Stage 2).

STAGE 4: Implementation Strategy. Develop an implementation strategy that will bring action to each of the identified management actions noted in Stage 3.

STAGE 5: Plan Review. On a five year cycle the plan will be reviewed to update all aspects of the plan (Stage 1-4). Membership of the Working Committee to be updated; any new or revised information concerning the watershed assessment to be noted; revision or addition to management action to be made; any changes to the implementation strategy to be noted. Generally, the goals and objectives of the plan will be reviewed for their accuracy, appropriateness, any major changes or additions will require public notice and engagement prior to adoption.

…/2

Figure 1: A proposed watershed planning framework, Pike Lake, SK.



STAGE 2: Watershed Assessment is based on local knowledge and professional reports with a goal of providing:

1. A detailed description of the watershed area, physical, historical, social context
2. An inventory of potential risks (natural, human caused) to physical environment within the watershed
3. A risk assessment
4. A risk ranking

Appendix C: DRAINAGE BOUNDARY MAP

See following page

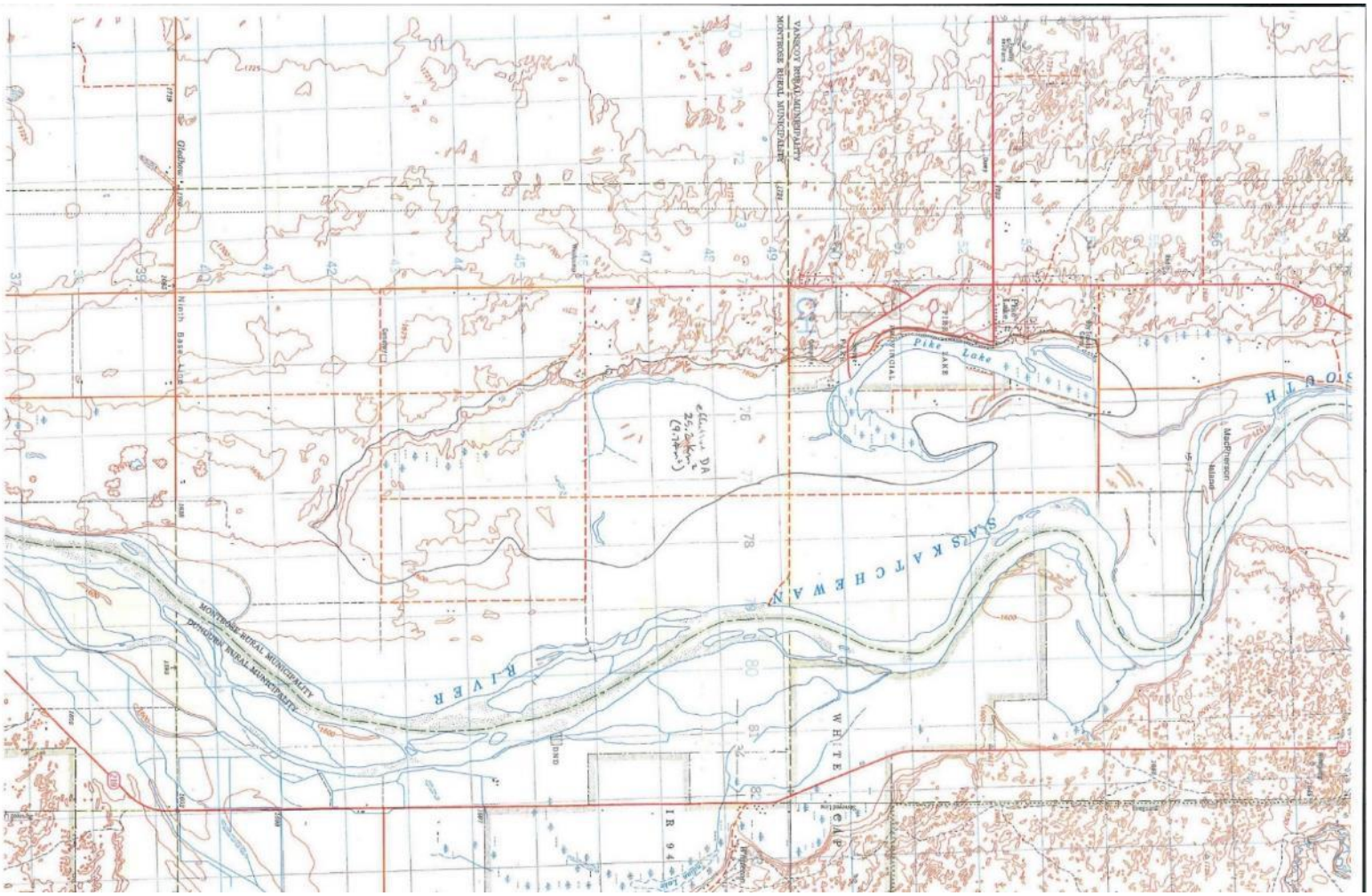


Figure C.1: Interpretation of the drainage boundary around Pike Lake, Saskatchewan.

Provided by Gord Hagen, Moosejaw, SK Water Security Agency, 2014. Received via personal communication in the form of a PDF computer file. The map is based on an undated and uncited NTS topographic map (corresponds to 072O15), with maroon isolines depicting topography, solid and dashed red lines depicting roads, and blue lines for water features; the drainage boundary is hand-marked in black. North is to the top of the page.